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CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Briefly Told 89

Obituary Note, Robert C. Reaves—The Holyoke Municipal Lighting Showing for the Year—A Rochester (N. H.) Contest—Current Comment.

Proceedings American Gas Institute, Second Annual Meeting—Continued from page 56 90

Second Day, Morning Session—Report of the Public Policy Committee, Concluded—U. G. I. Beneficial Association—The Procter & Gamble Co.—N. O. Nelson Mfg. Co.—Discussion—Report of the Rate Committee—*Lecture on Electrolysis, by Prof. A. F. Ganz—A Hearty Vote of Thanks.

*House Gas and Moving Picture Machines, by "R." 101

Gas Heated Sheet Metal Hot Water Radiator 101

Incongruities in Specifying Amounts of Illumination 102

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 102

Cheaper Gas for Bath, Me.—Personal—Ditto—Decreased Selling Rate—Annual Meeting, Omaha, Neb.—Gas Illumination and Shop Practice—Four Short Ones—The Wooster, O., Plant Not to be Shut Down—An Interesting Exhibit—A Woman to the Rescue—A Budget of News—Dollar Rate for Millville, N. J.—An Extension of Time—Three Personals—Supt. Goodwin as a Lecturer—Supt. McCuen's Figures—Annual Meeting, St. Albans, Vt.—Mr. Blake Tries to Jolly Joliet—An Important Decision—And Other Items.

The Market for Gas Securities 104

BRIEFLY TOLD.

OBITUARY NOTE, ROBERT C. REAVES.—With great regret we are obliged to chronicle the death of Mr. Robert C. Reaves, for many years Superintendent of the plants of the Scranton (Pa.) Gas and Water Company, who passed away, at his home in Scranton, the morning of the 9th inst. Deceased was born in Carbondale, Pa., June 30, 1856, and shortly after his birth his parents moved to Pittston, Pa., in which settlement his time to young manhood was spent. Having acquired a common school education he became attached to the engineering corps of the Delaware, Lackawanna and Western Railway Company, and his course in that connection was diligent and studious to the point that enabled him in due time to rightfully bear the title of Civil Engineer. In common with the balance of the Keystone State the Pittston section was developing largely, and the development enlisted the services of men of his calling, and promotion for them was both certain and rapid. His ability as an engineer soon attracted the attention of Mr. W. W. Scranton, whose water and gas properties needed close supervision, so great was the growth of the districts that these plants were constructed to supply with the two necessaries. Step by step he aided in their perfecting, and for several years he has been the engineering head of the Company which stands to-day a monument to the never-blinking farsightedness of W. W. Scranton. This management, in fact, may be said to have constituted his life's work. Naturally, from his position, he was well known and prominent through the Scranton district, and it can be truthfully said that his prominence was no greater than was his popularity. He is survived by his father, Mr. P. A. Reaves, his son Robert, a sister and a brother. The latter is well known in the business life of Providence, R. I.

THE HOLYOKE MUNICIPAL LIGHTING SHOWING FOR THE YEAR.—We are indebted to Mr. P. R. Stafford for the following, respecting the annual reports of those in charge of the municipal lighting department of Holyoke, Mass. The gas output, for the year ended December 31, exceeded that of the previous twelvemonth by 27 millions cubic feet, or a percentage gain of 20.10. The increase in the electric division is returned at 28 per cent. During the year the rate for arc lamps used in lighting the streets was $60 per arc, a cut of $20 per lamp. It is not claimed that any profit is shown in this price which was only made possible by the general increase in the income of the department. The electrical plant was enlarged considerably during the year. The total income from operation was $314,842, of which sum $7,615 is chargeable to coke account, and the authorities figure that the plants earned for the city a total of $54,930. Right after the reception of the report it was determined to cut the charge for electric current to 6 cents from 10 cents per kilowatt, the new schedule to become effective the first prox. The gas rate is $1 per 1,000.

A ROCHESTER (N. H.) CONTEST.—"M. V. R." writing from Rochester, N. H., under date of the 10th inst., incloses the following: "Late last summer the Rochester Gas Light Company offered a cash prize of $50 for the best essay by a pupil in the graduating classes of the Public High School and the parochial school, the subject of the essay to be 'A Gas Range.' The tribunal selected to judge the communications submitted was composed of the Rev. Joseph Corcoran, of St. Mary's Church, City Solicitor S. D. Felker and Mr. B. Q. Bond, Cashier of the Rochester National Bank. Quite a number tried for the prize, which was eventually determined to have been won by Miss Louise Perkins, a senior in the Rochester High School."

CURRENT COMMENT.—

WILLIAM R. THOMPSON, since 1872 in the service of the gas supply of Philadelphia, both under municipal control and the domination of the U. G. I. Company, died in that city the morning of the 13th inst. He was born in 1847, and in 1863, young though he was, served in the Shenandoah Valley campaign of General Phil. Sheridan, as a member of the First New York Cavalry.

THERE is less howling in Omaha, Neb., respecting the heating quality of the gas supplied there, since the appointment of an official municipal analyzer. That position is held by Commissioner Crowley, who during December last made 8 official examinations of the gas furnished. The figures showed an average of 616.5 B.T.U.'s., as against 600 required under the ordinance.

A BILL recently introduced in the New York Legislature by Senator Sohmer prohibits the placing of valves and appliances for heating sleeping apartments with gas within 12 inches from the point of connection of piping with a wall bracket for lighting purposes, under

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quires the placing of valves for such appliances on side wall piping where a connected light is a drop light from the ceiling. Violation of the regulation is made a misdemeanor, the penalty being a fine ranging between $50 and $100.

A RECEIVER has been appointed to manage the affairs of the Ironton (O.) Gas Company, and a prayer for its dissolution has been proposed.

THE authorities at Beech Haven, N. J., are considering the advisability of there constructing a gas works to be operated on municipal account.

THE January meeting of the Philadelphia Section of the Illuminating Engineering Society was set for last Friday, in the Assembly Room of the Philadelphia Electric Company, 10th and Chestnut streets. The paper on the programme was by Mr. F. N. Morton, who elected to speak on the "History of Photometric Standards." The lantern-slide system of illustrating was to be freely availed of. Officers for the ensuing year were also to be chosen.

MR. GEORGE W. GRAVES informs us that, having secured all the rights owned by J. F. Mills in the patents covering gas oven burner lighters, known to the trade as the "oven-door lighter," all propositions made by the said Mills, or by George W. Graves, are hereby withdrawn.

THE Louisville Gas Company has declared a regular semi-annual dividend of 3½ per cent. on its capital stock.

WE are informed that the Ware (Mass.) Gas Light Company is no longer a department or division of the Otis Company, it having been converted to a separate and distinct corporation, although its capital is mainly in the hands of those formerly identified therewith. The incorporation was completed something over a month ago. It is capitalized in $15,000, and its officers are: President, Chas. H. Fiske; Treasurer, Orlando H. Alford; Managing Director, Francis W. Fabyan. During the year the plant has been practically rebuilt, and prominent in the construction might be noted a storage holder up to retaining 100,000 cubic feet. The general sale of gas throughout Ware will now be undertaken in earnest.

THE city market under Tomlinson Hall, Indianapolis, Ind., is to be lighted by gas lamps of the arc type, to the displacing of the arc electric lamps now in use. It is estimated that the saving under the new arrangement will amount to 33⅓ per cent. at least, in money, to say nothing of the better illumination secured.

THE old guard of the fraternity will note with surprise that it was not until the 10th inst. that death claimed Mrs. Ann Prichit, widow of the late Samuel Prichit, a founder of the Nashville (Tenn.) Gas Light Company. Deceased was in her 94th year. She is survived by one son, Mr. Samuel Prichit, who is now a resident of Nashville.

ADVICES by way of Eureka, Cal., under date of the 12th inst., are to the effect that all of the stock of the Eureka Lighting Company has been transferred to the Humboldt Gas and Electric Company, which will eventually absorb both lighting Companies now doing business in Eureka.

AT the annual meeting of the Olympia (Wash.) Gas and Power Company the Directors elected were: M. S. Dole, R. A. Leiter, F. E. Smith, E. M. Kennard and A. E. Wright. The Directors subsequently elected the following management: President, E. M. Kennard; Vice-President, F. E. Smith; Secretary and Treasurer, W. S. Dole; Superintendent, A. E. Wright.

AT the annual meeting of the Boise (Idaho) Gas Light Company, which is to be held to-morrow, the shareholders will be called upon to assent to a new issue of $200,000, 5 per cent., 30-year sinking fund bonds.

WORK on the further piping of the streets of Brookfield, Mass., for a gas supply, is underway, by the Worcester County Gas Company.

THE contract for rehabilitating the piping system of the Richmond (Va.) Municipal Gas Works has been awarded to the Atlantic Bitulithic Company, at its bid of $27,000.

BARON SHIBUSAWA, of the Tokyo (Japan) Gas Company, is the foremost member of the syndicate which proposes to construct and operate a gas works in Seoul, Corea.

THE third taxpayer on the Boston tax rolls is the Boston Consolidated Gas Company. Its valuation is put at $13,502,200, on which basis the tax payment is $214,684.

[Continued from page 56.]

PROCEEDINGS AMERICAN GAS INSTITUTE, SECOND ANNUAL MEETING, HELD AT THE NEW WILLARD HOTEL, WASHINGTON, D. C., OCTOBER 16, 17 AND 18, 1907.

SECOND DAY—MORNING SESSION.

REPORT OF THE PUBLIC POLICY COMMITTEE.[1]

Constitution and By-Laws, the U. G. I. Beneficial Association, of Philadelphia, 1904.

CONSTITUTION.—ARTICLE I.—NAME.

This Association shall be known as the U. G. I. Beneficial Association, of Philadelphia.

ARTICLE II.—OFFICERS.

Section 1. The officers of this Association shall consist of a President, Vice-President, Secretary, Assistant Secretary, Treasurer, Assistant Treasurer, and 15 Trustees, to be nominated annually at the meeting in December and be elected at the meeting in January.

Sec. 2. It shall be the duty of the President, who shall be *ex-officio* a member of the Board of Trustees, to preside at all meetings of the Association and of the Board, to countersign all checks signed by the Treasurer, to appoint all committees, except as hereinafter provided for, and to perform all other duties pertaining to the office. He shall serve without compensation.

Sec. 3. It shall be the duty of the Vice-President to preside in the absence of the President and perform all duties pertaining to that office, and his performance thereof shall be conclusive evidence of his right to act. He shall serve without compensation.

Sec. 4. It shall be the duty of the Secretary to keep a correct record of the proceedings of the Association, to collect all dues and assessments of members (keeping a record of same), paying such money to the Treasurer, taking his receipt therefor. He shall give written notice to members who are 1 month in arrears, and perform such other duties as the Association may require. He shall furnish to the Association a bond with such surety and in such amount as shall be approved by the Board of Trustees, the premium upon which shall be paid by the Association. He shall serve without compensation.

Sec. 5. In the case of the absence of the Secretary, or of his inability to act, it shall be the duty of the Assistant Secretary to perform all the duties of the Secretary, and his performance thereof shall be conclusive evidence of his right to act. He shall serve without compensation.

Sec. 6. It shall be the duty of the Treasurer to receive all money in the name of the Association and to pay only in accordance with the constitution and by-laws of the Association and as ordered by the Board of Trustees. All checks shall be signed by the Treasurer and countersigned by the President. The Treasurer shall furnish to the Association a bond with such surety and in such amount as shall be approved by the Board of Trustees, the premium upon which shall be paid by the Association. He shall serve without compensation.

Sec. 7. In the case of the absence of the Treasurer, or of his inability to act, it shall be the duty of the Assistant Treasurer to perform all the duties of the Treasurer, and his performance thereof shall be conclusive evidence of his right to act. He shall serve without compensation.

Sec. 8. The Trustees shall appoint a Membership Committee of 5 members. They shall also determine the amount and surety of the bonds of the various officers of this Association.

ARTICLE III.

Section 1. Candidates for membership in this Association must be at time of application employed by or connected with the United Gas Improvement Company or affiliated companies located in Philadelphia.

Sec. 2. Applications for membership must be presented in writing to the Board of Trustees, giving name, age, residence and occupation, attested by the head of the department where said applicant may be located. The application (with the name of the member proposing same attached) shall be accompanied by an entrance fee of $1 and the first month's dues, which shall be returned should the applicant be rejected. The application shall be referred to the Membership Committee, who shall inquire into said application, and if the application is in proper form and the applicant eligible for membership in the Association, the applicant shall be declared a member and be entitled to all the benefits and privileges of the Association.

1. Concluded from page 86.

ARTICLE IV.

Section 1. The monthly dues of each member shall be 25 cents, payable in advance at each stated meeting of this Association.

Sec. 2. Upon the death of any and each member there shall be an assessment of 25 cents, payable at the next stated meeting, unless there shall be a surplus in the Treasurer's hands of at least $1,500, said assessment to again become operative when the surplus in the Treasurer's hands shall be reduced to $500, and in no case shall there be more than one assessment in any one month.

Sec. 3. Any member who shall be in arrears for 2 consecutive months shall thereupon cease to be a member of this Association, and shall immediately forfeit all rights and privileges of membership in the Association, except the right of reinstatement within 12 months after the failure to pay dues, such reinstatement to be immediately declared by the Membership Committee upon the presentation of application of the same character as provided for in Section 2 of Article III., and upon the payment by said person to the Secretary of the regular initiation fee of $1, together with the first month's dues of 25 cents.

Sec. 4. Any member who shall not pay a death assessment as prescribed in Article IV., Section 2, within 30 days after the same is made, shall thereupon cease to be a member of the Association and shall immediately forfeit all rights and privileges of membership in the Association, except the right of reinstatement within 12 months after the failure to pay assessment, such reinstatement to be immediately declared by the Membership Committee upon the presentation of application of the same character as provided for in Section 2 of Article III., and upon the payment by said person to the Secretary of the regular initiation fee of $1, together with the first month's dues of 25 cents.

ARTICLE V.

Section 1. Upon notification to the President of the death of a member the President shall select one of the Trustees, whose duty it shall be to immediately inquire into the reported death of the member, and if he shall find such death has occurred, he shall report the same to the Secretary in writing. The Secretary shall thereupon inform the Treasurer of this fact and file with the Treasurer the report signed by the Trustee. The Secretary's notice, together with the report of the Trustee, shall be the authority of the Treasurer and President to sign and countersign check of the Association for the payment of the benefit, which shall be the sum of $150. Payment of benefit on account of the death of a member shall be made within 3 days after notice of death to the President, to such person or persons as said member shall designate in writing, either upon his original application for membership or by written designation filed subsequently thereto with the Secretary of the Association. If there be no such designated beneficiary living at the member's death then the said benefit shall be divided, distributed and paid by the Association to and among the persons who would be entitled to receive the same in accordance with the laws of the State where such person is domiciled in cases of intestacy. In any case in which notice in writing of the existence of any such person shall not be served on the President of the Association within 12 months after such member's death, it shall be treated as conclusive that there are no such persons in existence, and thereupon the said benefit shall be treated as absolutely lapsed and extinguished.

ARTICLE VI.

Section 1. No assignment of benefits shall be recognized by the Association, and if the right of the beneficiaries designated by the members in accordance with this Constitution to such benefits shall in any manner become alienated, the obligation to pay such benefits shall thereupon cease.

ARTICLE VII.

Section 1. This Constitution shall become effective December 16, 1904.

ARTICLE VIII.

Section 1. No alterations or amendments shall be made to this Constitution except the same be proposed in writing at a stated meeting, when it shall be laid over for consideration at the next stated meeting, and notice of which shall be mailed or delivered to all members of the Association 10 days prior to such meeting.

BY-LAWS.—ARTICLE I.

Section 1. The stated meetings of this Association shall be held on the 16th day of each month, save when that day shall be a Sunday or a legal holiday, in which case it shall be the next secular day following that date.

Sec. 2. Fifteen members shall constitute a quorum, but a less number may meet and adjourn from time to time.

ARTICLE II.

Section 1. Meetings of the Board of Trustees shall be held at the call of the President or at the request of 3 members of the Board.

ARTICLE III.

Section 1. Every member must give his place of residence to the Secretary, and in case of removal he shall notify the Secretary thereof. All notices sent to the address appearing on the books of the Secretary shall be deemed to be the correct address of the member.

ARTICLE IV.

Section 1. The funds of the Association shall not be used for any other purpose than for the death benefits and the legitimate running expenses of this Association.

ARTICLE V.

Section 1. No part of these By-Laws shall be altered, suspended, or amended unless a motion in writing be presented 1 month previous to the day it shall be considered, and notice of which shall be mailed or delivered to all members of the Association 10 days prior to such meeting; and if two-thirds of the members present vote in favor of the motion, it shall be adopted.

Rules of Order.

No. 1. The President shall take the chair at the hour at which the Association meets, and upon the appearance of a quorum he shall open a meeting. Business shall be taken up in the following order: Call to order; reading of the minutes of the last stated meeting; reports of trustees; reports of committees; payment of dues; report of delinquent members; unfinished business; new business; secretary's report; adjournment.

No. 2. A motion when made must be seconded before it can be debated. When a question is under debate no motion can be received except to divide, amend, indefinitely postpone, lay on the table, or adjourn. A motion to adjourn is always in order and is not debatable.

No. 3. Every member must when speaking address the presiding officer. On questions of order no member shall speak more than once. On all other questions members may speak twice, not oftener, unless by the consent of the presiding officer.

THE PROCTOR & GAMBLE CO.,
CINCINNATI, O., Aug. 19, 1907.

Mr. Alanson P. Lathrop, New York city: Dear Sir—Your favor of the 12th inst. has our attention.

We inclose herewith the reprint of an article which our General Manager wrote for the New York *Independent* some years ago. The plan and our experience in connection with it were practically unchanged up to July 1, 1903. At that time there was a modification which we believe will strengthen the cordial relations which exist between our Company and its employees.

We now require that an employee, to share in the profit-sharing dividend, shall own common stock of the Company to an amount equal in market value to a year's wages or salary. If an employee does not hold this amount of stock we offer to buy it for him or for her. When the purchase is made, a small first payment is required, and other small annual payments are required until the cost of the stock has been paid. Interest is charged in the meantime at the rate of 3 per cent. per annum and the employee is guaranteed by the Company against decline.

The majority of our employees have taken advantage of this offer and will hereafter receive a profit-sharing dividend and also the regular dividend which is paid to holders of the common stock.

These dividends of late years have been 12 per cent.; that is, an employee earning $500 a year in wages or salary gets a profit-sharing dividend of $60 in addition to the 12 per cent. dividend on his stock.

If the employee is indebted to us for stock purchased for his account, the dividends are credited to him until the stock is paid for.

It will be evident to you that our object in amending our plan and in encouraging our people to become stockkolders, is to have them feel the additional interest in the welfare of the Company which comes from actual investment and part ownership.

The details given above will, we hope, be interesting, and if we can add anything in the way of information, do not hesitate to call upon us for it. Yours very truly, THE PROCTOR & GAMBLE CO.,

By R. H. ROGERS.

An Experiment in Profit-Sharing.—Any change in the methods

of conducting the productive and distributive business in the world, to be successful and generally adopted, must first and last have in it that which tends to lessen the cost of such production or distribution. However desirable profit-sharing may appear to us from other points of view, this is the essential principle upon which its success or failure depends. Unless the employer increases the efficiency of his labor under the profit-sharing plan to at least the extent of the profits so paid to his labor, he should not, as a business proposition, adopt it. If, however, the reverse is true and he increases the efficiency of his labor to an extent greater than the amount so paid to it, it is as incumbent upon him to adopt the profit-sharing plan as it is to put in an improved piece of machinery, remembering, also, that it is the first who in adopting improved methods secures the greatest reward. If profit-sharing can show that where it is honestly and considerately administered it is the means of developing in the employee that feeling of self-interest in his labor which will tend to secure the same thoughtful and honest efforts as though he were working for himself, then it has demonstrated its right of being, as the main claim of the employer is that the root of existing troubles lies in the fact that the employee takes no interest in his work and has no consideration for his employer's property or welfare.

Now, how can profit-sharing prove its ability to produce this change in the employee's feelings? If it can be shown in a manufacturing establishment continuing under the same management, even down to practically the same foremen of departments, that since profit-sharing has been introduced, strikes and labor troubles are unknown, where before they were common; that the waste of material has been reduced one-half; that the number of employees leaving the employ or being discharged for cause during the year has been reduced to one-third the number so doing prior to the adoption of the system, and that the actual labor cost of manufacture, including in such cost the amount of money paid to employees as the profit-sharing dividend, has been lowered, then we think profit sharing will be justified in claiming that it has supplied that motive to self-interest in the employees' work, which is now admitted to be so sadly lacking.

It was during the year 1886 that the Knights of Labor began to assume such prominence, and employees in manufacturing establishments throughout the country became more or less restless. During that year the firm of Proctor & Gamble, soap manufacturers, Cincinnati, had in their various departments no less than 14 different strikes, having at different times from 11 to 114 of their employees quit work in a body, and for all sorts of trivial causes. They were continually at the expense of breaking in new people, and the question was one of constant anxiety. After considerable hesitation it was decided to put into force a plan of profit-sharing and to secure if possible some relief from these troubles. It was decided to allow as a portion of the expense of manufacturing a reasonable salary to each active member of the firm, and to divide the remainder of the net profits between the firm and the employees in the proportion that the labor cost of production bore to the total cost of production. In other words, if the sales were $100,000 and the net profits, after deducting the salaries of the firm, $10,000, then the total cost of production would be $90,000. Assuming that the amount paid for wages was $20,000, then the $10,000 of profit would be divided, ⅓ to the firm and ⅔ to the employees.

The proposition when made to the employees was accepted in a half-hearted way and without any belief upon their part that it would be of material benefit to them. At the end of 6 months a dividend of 11 per cent. upon the wages was declared. During the next 6 months there was evidence that some of the employees were beginning to take a little interest in the working of the plan, and in order to encourage them and to reprimand those who did not take an interest, the plan was adopted of dividing the employees into 4 classes, the first class getting double the regular dividend and including those who showed unmistakable signs of appreciation of the fact that it was incumbent upon them to help make the profits. The second class received the regular dividend and included the bulk of the employees. The third class were those who did not evince much interest in the plan and whose dividend was ½ the regular amount. The fourth class were those who for cause were cut out of any dividend at all. They continued working under this plan for 2 years, by which time they had managed to weed out the majority of those who took no interest in their work, and since then have had only 2 classes, those who share and those who do not. The total amount of profit-sharing dividend is not affected by the number of those sharing. If for any reason they are compelled to decline allowing an employee to participate, his share is divided among the others.

This, briefly, is the plan under which the Proctor & Gamble Company are to-day working. In the year 1887, the first year in which the plan was in operation, they had 3 strikes during the first 6 months. Since that time they have had absolutely no labor trouble. We believe it would be impossible to foment any such trouble among the employees now. As an illustration of how they feel, we might mention that it has occurred frequently, that where some troublesome fellow has tried to produce dissatisfaction, the men themselves will come to the foremen and tell them all the details of it and suggest that the man be discharged. The old feelings of discontent and distrust have been replaced by those of mutual interest.

The class of labor employed in the soap factory is of the most ordinary unskilled kind. Over 85 per cent. of our employees earn $1.50 a day or less. This class of labor is the kind that most frequently shifts from place to place and is the class which of necessity you must frequently change. We are at the moment without exact figures relative to the proportion of employees who would continue for a year in the factories prior to 1887, but we think it a conservative estimate to say that one-half of the employees were replaced each year by new men. Last year, out of over 600 employees, we had 6 who left or were discharged for cause. Three of these were girls who were married, and 2 of them were men whom we discharged for being in a drunken fight, even though not in working hours. The sixth employee left for some reason which we do not know. Too much stress cannot be placed upon the advantage of being able to retain the employees year after year. Even though the labor is unskilled, it takes some time to break in a new man so that he is as efficient as one who is familiar with the work to be done.

It is very difficult to determine exactly what proportion of the labor saving that has been effected in our factories, since the profit-sharing plan has been in force, is due directly to the profit-sharing plan, and what is due to improved machinery and methods of manufacture. Our labor cost of manufacture, including a 12 per cent. profit-sharing dividend upon the wages for the year 1894, was 63 per cent. of what it was during the year 1886, and this in spite of the fact that the average rate of wages in 1894 was a trifle over 12 per cent. higher than in 1886. Figuring conservatively, and throwing all questionable items against profit-sharing, they estimate that the improved methods of manufacture are responsible for 28 per cent. of the 37 per cent. shown, leaving as a net result to the credit of profit-sharing, a saving equal to 9 per cent. plus 12 per cent. increased wages, or 21 per cent. cheaper labor cost of manufacture under the profit-sharing system.

As to the saving in material, this also is a difficult question to determine. Unfortunately, it is not possible to keep accurate account of saving under this head. We can instance, however, one thing which shows how the profit-sharing plan works. One of the principal sources of waste in the factories is due to the waste of scraps and small pieces of soap by allowing them to fall upon the floor and become trampled under foot. This dirty soap used to accumulate so rapidly that it was necessary to work over the accumulation every 2 or 3 weeks. Now it takes 3 or 4 months to accumulate a sufficient quantity to be rehandled. The effect of saving by the employees can also be seen in the general air of tidiness and cleanliness about the factories.

There is no question that in The Proctor & Gamble Co.'s factory, profit-sharing has done more than answer the questions propounded above, and the tendency has been, wherever possible, to extend this same profit-sharing principle, and to encourage more and more the spirit that it has started among the employees. This has been done by having employees become interested in the stock of the Company, trying to induce them to put their savings into the business for which they are working, so that all their interests shall be in one place. As an instance of the willingness of the employees to bind themselves more closely to their work, we would mention that, after the last semi-annual profit-sharing dividend, the employees subscribed for $5,250 worth of the common stock of the Company.

While the profit-sharing plan is to-day working so smoothly and profitably to the interests of the *capital* invested in the business, yet it must not be assumed that it came to this state without any drawbacks or disheartening circumstances. The employees of the Company were of the ordinary type of day laborers, ignorant and suspicious; and it was only by absolute fairness and justice in ruling upon all claims and allowances to be made for them, that the management had succeeded in fully gaining their confidence. We do not think that any person who will adopt the profit-sharing plan need expect that it will pay its own way for the first 2 years; but after that, if the employer will do his share of it and treat the employees with

consideration and with an effort to show appreciation for any attempts they may make, even though misguided, to improve the work of their department, we feel assured that the ultimate outcome can only be to the more firm establishment of the system. It is by no means an uncommon occurrence now for the employees of The Proctor & Gamble Co. to show decided interest in the character of the goods being shipped, taking especial pride and pains in those in which they assume that the larger profit is made. They will call the attention of the foreman to little questions as to quality of the different brands of soap manufactured, showing plainly a desire upon their part that they shall do their share in seeing that nothing goes out from the factories which would tend to injure the demand for the products of their labor.

These results have been obtained during a period of time when the feeling between employer and employee generally has been strong and bitter. The spirit of bitterness had already developed in the Proctor & Gamble factories, showing that there was nothing peculiar to their management that would exempt them from the same troubles so many others have had. The results have been obtained not at any cost of profits to the capital invested, but at an actual increase of profits to the capital. All that was done was to allow the employee an opportunity to save money for himself. He did it and more.

We have never been forced to meet the question: What would be done in the event that no profits were earned or that a loss was incurred? We have told our employees that we would not expect them to share in any losses. We feel that even in the event of a year's business showing a loss, it would be an injustice to ask them to bear any porportion of it beyond the loss they already sustained during the year by giving the increased efforts and care for which they received no recompense.—Wm. Cooper Proctor, in the *Independent*, May 2, 1895.

N. O. Nelson Mfg. Co., St. Louis.—There are new customers and new readers who do not know our business plan. There are some old ones who have forgotten, and some who never get it clearly in mind. It will bear restating. We are an ordinary corporation, doing business in the ordinary way. Employees are paid full salaries and wages. Customers buy goods at market prices. I own the majority of the capital stock, for which I take no part of its annual earnings. The stock owned by the employees and the customers gets 6 per cent annual cash dividends. We spend some money on educational and social work among our employees. We care for our sick and disabled, and we spend some on public benevolence; this takes about one-fifth of the entire profit. The other four-fifths is divided among the employees and customers; it is paid in my stock at its face value. The dividend to employees is in proportion to their pay. The dividend to customers is in proportion to the profit we make on their purchases. We divided among ourselves last year, 1906, $177,500 from the profits of the year. "We" means all the employees and all the customers of the N. O. Nelson Mfg. Co. (Employees who have worked less than 6 months and customers who have traded less than $100 within the year are not counted.) We didn't pay out the money, but added most of it to the working capital. We made some additions to our factories, built homes, and made other good uses of it. The employees and customers got stock in the Company for their shares, and before long they will own the Company. That labor got 25 per cent. dividend last year in place of 15 per cent. the year before, and the customers an average of 7 per cent. on purchases instead of 4, was partly or mainly due to the co-operative interest of both. The proportion for the present year will be the same as last year, as 5 on wages is to 9 on customers' gross profits. If times continue good and the employees improve, and the customers buy more, with no increased expense, then the dividend rate will be larger, and the total larger. Reversing these conditions, they will be smaller. Paying the dividends in stock serves the purpose of increasing the capital to take care of more business, transferring the ownership from me to the employees and customers, making it co-operative in place of private, and securing a 6 per cent. cash stock which is better standby for the uncertain future than can be had in any other way. The stock is the absolute property of the holder, there is no string to it. To safeguard the plan, the stock is made transferrable only on the books of the Company. We have adopted the regulation co-operative plan of half dividend to non-members; that is, those who prefer a cash dividend rather than a stock dividend. He may take his half dividend in cash and remain a non-member, or he may take full dividend in stock and be a member. It is optional with him. The plan is to turn the whole business over to employees and customers without any payment from them, the dividends paying for the stock. When that is done, they will own a large and very valuable property, the big St. Louis store, the splendid Leclaire and Bessemer factories, the stocks of goods in St. Louis, Leclair, Bessemer, Los Angeles, San Francisco and Pueblo.

Discussion.

Having finished reading the selected extracts Mr. Gardiner went on to say: That portion of the report covered on pages 1 and 2 is the report of the whole Committee, and it is the only statement for which the whole Committee is responsible. In addition to that, each sub-committee, with the exception of that on "Taxation and Franchises," has drawn a report through the General Committee. Our time is very limited indeed this afternoon, and, therefore, while the questions of "Publicity and Popular Education," "Industrial Insurance" and "Rewards and Pensions," are very important, unless there is objection I will pass those over in the discussion and presentation of this matter and take up only the question of "Public Regulations and Control," and the London sliding scale as applied to gas. I hope that no one will hesitate to correct me if I am in error in saying that those two questions are perhaps, and particularly the question of "Public Regulations," the most pressing in our thought at the present time. Therefore, with your permission, I will read the report of the sub-committees on those two subjects. The first is the report of the sub-committee on "Public Regulations and Control," that sub-committee being composed of Mr. F. W. Little, Chairman, and Mr. A. P. Lathrop. [Mr. Gardiner read the report of the sub-committee on "Public Regulations and Control to the Public Policy Committee," as covered on pages 3, 4 and 5 of the printed report. Continuing he said:] After that follows the report of the sub-committee on the London sliding scale as applied to gas. I will not attempt to read this report in full as it covers some 10 pages. With your permission, however, I will make a verbal introduction, and then read a portion which I think should be called to your attention. The London sliding scale is not a matter of rates or anything of the kind. It is a reciprocal arrangement or device which may be entered into by a company under city regulation whereby a standard of fair price, particularly a price whereby the company gets a return on the value of the property which increases at a proportional ratio, the device consisting in simply saying to the corporation, "Now, if you will continue to lower prices, we will allow you to pay a proportional increase on the earnings over and above your initial fair returns, because we find that, by making it worth your while to do that, we can get better results than by continually hammering you down to a minimum of return which you can insist on under the 14th amendment to the Constitution." That is the whole thing. This device has been used in Boston for some time, a matter of 18 months or so, and am told has worked very well there; but I think that the American Gas Institute should not at this present moment advise its general adoption because of the conditions there, and for the reason that it is bringing about a very marked change in local conditions which may have its contagious effect elsewhere. Therefore, with your permission, I am going to read an extract from a statement published last June. [Mr. Gardiner read from the report of the sub-committee on the London sliding scale as applied to gas, as given upon pages 6, 7, 8, 9, 10, 11 and 12 of the report of the Committee. He then went on to say:] There is only one word I want to add to that. There are many methods of arriving at such an arrangement, but I want to urge upon the Committee, or upon the members of the Institute, to give very careful consideration to this plan. I consider the English claims, however, to be very deficient in a great many points. There has been more or less criticism in this country, especially in the National Electric Light Association, and from various other sources of the methods of arriving at these ends, but I trust the members of the Institute will give it careful attention with the idea of eliminating certain things which may suggest themselves. I trust, gentlemen, we shall hear some discussion on this question.

The President—Gentlemen, you have heard the report of the Public Policy Committee. Are there any remarks?

Dr. Humphreys—I would like to say a word or two in regard to the last sub-report in reference to the London sliding scale. I do not wish now to discuss the merits of the scheme. It unquestionably has merit if properly applied in connection with local conditions, but I feel that the Boston experiment as a whole is going to be misleading to the public and to public officials. Conditions there are decidedly local, and unless those local conditions are understood, or if the Boston scheme is understood to be generally applicable, the gas companies of the United States are going to have trouble. I would like to draw attention to another feature, which is that possibly, in view of the way

in which the report was prepared, it might lead to a misunderstanding. In England the standard rate is fixed on a fairly generous basis, hence the companies have a good working chance to cut the price. In the United States the tendency appears to be to fix a price upon a so-called fair rate of return, but in reality a low rate of return upon a low rate of capitalization. Such a policy would at once defeat the object arrived at by the sliding scale scheme.

Mr. A. S. Miller—I did not exactly catch whether the Committee recommended to the Institute the general adoption of that by all gas associations. It was not entirely clear. I would like to have it cleared up, if possible, whether they make a general recommendation to the Institute that they use their influence through the cities to get the associations to recommend in regard to that.

The President—What you want to know is, what the language of the Committee's report is on that matter?

Mr. A. S. Miller—Exactly; and what the adoption of the report is going to carry with it.

Mr. Gardiner—Perhaps I can best answer that by quoting from the report itself. One of the conclusions of your sub-Committee was: "That the change from the policy of open competition as a regulating force, and from secret accounting to State supervision and regulation with public accounting, is not inimical to the interests of the owners of gas properties, provided it is accompanied by protection to the values of the properties supplying the public need. Such protection is as necessary to the public interest as to the corporations, since without it capital cannot be secured to make necessary extensions and improvements." The sub-Committee also makes other recommendations. Does that answer your question?

Mr. A. S. Miller—I think I understand what the recommendation is.

Mr. Thompson—I understand that automatically the report which has been submitted by these sub-Committees will be referred to the Public Relations Committee under the Constitution.

The President—Yes.

Mr. Shattuck—I move that the Public Policy Committee be discharged with the thanks of the Institute, and that the report be referred for consideration to the Public Relations Committee. [Seconded.]

The President—Gentlemen, you have heard Mr. Shattuck's motion that the Committee be discharged with the thanks of the Institute, and the report be referred to the Public Relations Committee. Those in favor say "Aye." Contrary minds, "No." [Adopted.]

The President then called for the

REPORT OF THE RATE COMMITTEE,

which was made by Mr. Gardiner (Chairman) as follows:

Mr. Gardiner—The Committee on Rates are in a peculiar position. At the last convention they outlined a long programme for the study of the rate problem, and in this (their second) report they undertook to take the first step on that programme, which was primarily to study the cost of definite gas service through a company as supplied to one customer, the detailed condition and situation to be thoroughly gone into. The report was prepared last June and was passed to one of the other members of the Committee. It finally reached the Secretary's hands on or about the first of September, I think. The Chairman had written to the Secretary, making it very clear that the intent of the Committee was solely to prepare a report which would bring out discussion on this vital question; and, second, that the Committee absolutely refused to make a report or take upon themselves the responsibility of presenting or crystalizing for this organization the question of the cost of the conduct of the business. We were simply trying to do what was thought would be of help to you, and it is up to you to make the statement. This report was drawn in such terms, and the Committee have internal evidence of the most positive kind to the effect that it is impossible to discuss this report thoroughly, intelligently and aggressively unless it has been studied. Two members of the Committee when asked said that they would, under no circumstances, even with some unusual knowledge of rates, think of discussing the matter unless they had time to prepare themselves. The Chairman made the point plain and issued a special request so that it could be studied, in order that it might be thoroughly discussed, or at least get opinions which would relieve the Committee of further responsibility. The report was passed by the Board of Directors; but unfortunately there was a misunderstanding, and it was withheld from printing without the Chairman of the Committee having been notified, the action occurring too late for him to take any effective action. The Committee, therefore, beg leave to withdraw the report, subject to such further action as the Institute wishes to take in the matter. In conclusion, the Committee wish to lay emphasis upon the great importance of this rate work. We want to lay emphasis on the fact that in the last year we saw more progress on behalf of technical men and public officials than had been made, I think, in the study of the question of rates and in the understanding of rates in any 5 years previous. I trust something of this nature will be carried out in the future.

Mr. Butterworth—In view of the importance of this matter, and the fact that the Committee find themselves in this situation, I move that the Committee be continued.

Mr. H. L. Doherty—I am a member of that Committee. I do not want to discourage Mr. Butterworth, but as his motion is not seconded, I move that the Committee be discharged.

The President—Two motions have been offered, with no second to either.

A Member—Mr. President, I will second Mr. Doherty's motion.

The President—Mr. Doherty's motion being seconded, are you ready for the question? Those in favor say "Aye." Contrary, "No." [Adopted.]

The President then introduced Prof. A. F. Ganz, of the Stevens Institute of Technology, Hoboken, N. J., who gave the following

LECTURE ON ELECTROLYSIS.

At the last meeting of the Institute the Committee on Electrolysis, for which I had the privilege of acting as Consulting Electrical Engineer, presented a report which contained abstracts of the most important reports and papers, on the subject of electrolysis from stray currents, published in America and Europe, together with conclusions and recommendations for the protection of underground pipes, and also a brief outline of the theory of electrolysis. The reports of electrolysis tests which have been published since then show generally the same results as the ones which were quoted, and I can indorse the conclusions and recommendations reached by the Committee more strongly to-day than when they were adopted.

In the discussion of the theory of electrolysis it was stated that wherever current passes from a pipe to ground electrolytic corrosion takes place and that a mere fraction of a volt may produce corrosion. It has been claimed by others that a voltage below 1½ volts cannot produce corrosion because it is below the disassociation voltage of water. This, however, is a mistake, because when current passes from iron through ground to iron and produces corrosion the counter electromotive force is only a small fraction of a volt. If current should leave an iron pipe in ground containing certain alkalies the iron would be in what is known in chemistry as the "passive" state, and oxygen would be liberated without producing corrosion. In this case there would be a counter electromotive force of 1½ volts, due to the disassociation of water, opposing the flow of current in such passive places.

This passive condition of iron has also been put forward as a source of protection for iron pipes. The question has been investigated by Prof. Haber,[1] of Karlsruhe, who found that this passive condition of iron rarely exists in the case of iron pipes in ground. The electrolytic effect of current leaving passive iron would in fact be to change the alkaline to an acid condition and so render the iron active; that is, subject to corrosion. If there should be both active and passive portions in a positive pipe the current would leave largely in the active places, because in the passive places there is the opposing electromotive force of 1½ volts, so that a corresponding increased density of current and of corrosion is set up in the active places where there is practically no counter electromotive force. I cannot see, therefore, that we can derive any encouragement for the protection of pipes from this theory of the passive state of iron.

A number of laboratory investigations on the effect of alternating current in producing electrolysis have also been published, and these indicate that an alternating current will produce electrolytic corrosion which is very much dependent upon the composition of the soil, and which varies in amount from a fraction of 1 per cent. to possibly 2 per cent. of the corrosion produced by an equivalent direct current. It would appear from this that, in certain cases, particularly in the case of lead pipe, even an alternating current may produce destructive corrosion. No experiences with stray alternating currents have, however, as yet been made public.

In Germany a special form of electrode for measuring earth potentials, which does not introduce uncertain polarization potentials, has been used, and also a special apparatus for directly measuring the current flowing through ground. These were devised by Prof. Haber, who has called them "non-polarizable electrode" and "earth ampere-

1. See "Zeitschrift fur Elektrochemie," Jan. 26, 1906.

meter," respectively; he has used them in an extensive series of tests upon the piping system of Karlsruhe. A description of the electrode and earth amperemeter, together with the results of these tests, was presented in a paper before the "Deutscher Verein von Gas und Wasserfachmännern," which is published in the "Transactions for 1906." These devices have also been used with success during the past year in the tests made by the German Electrolysis Committee.

The mode of testing a piping system for stray currents is of considerable importance and interest to gas engineers. As this was not touched upon in the report of last year, I will in what follows endeavor to give an outline of suitable methods for making such tests, and also briefly describe the construction and uses of the new German devices. I will lay special stress on methods which will serve to prove that corrosion was due to stray currents, and to prove the origin of these currents so as to fix the responsibility, as this is important and essential evidence in case of a lawsuit.

With the arrangement, usual with trolley roads, of connecting the negative terminal of the generator to the rails, the general path of the stray currents is from the rails through ground to the pipes at places distant from the power house, through the pipes, and from these through the ground back to the rails or to other return conductors in the vicinity of the power house. Where current flows from a rail to a buried pipe the rail assumes a positive potential with reference to the pipe; where current flows from a buried pipe to a rail the pipe assumes a positive potential with reference to the rail.

The first step in making an electrolysis survey of a piping system is, therefore, to measure potential differences between pipes and rails in a large number of places throughout the system in order to locate these points of current flow between pipes and rails. As gas mains are not generally accessible, service or drip connections are used for making connection with the voltmeter. For this purpose one voltmeter wire is clamped or otherwise fastened to the drip or service connection, care being taken to clean with a file the part where the wire is fastened so as to insure good metallic contact. The other voltmeter wire is best soldered to a rough, flat file which is held on the rail for the contact, and which can be quickly removed and replaced when a car passes. The voltmeter for these measurements should have a high resistance so that an accidental poor contact at a drip or service connection will not seriously interfere with the measurement. A suitable instrument is a portable, high-resistance, Weston voltmeter with zero center, having ranges of 1.5, 15 and 150 volts. Readings should be taken every 10 seconds for 10 minutes at each point, and the maximum, minimum and average reading noted. The average readings are then conveniently marked upon a map showing the principal pipes and tracks, red numbers being used where the pipes are positive to the rails and black or blue numbers where these are negative. An excellent plan is also to plot these potential differences graphically upon a map on which the pipes are shown as lines and using these lines for axes, and the voltmeter readings for ordinates; by shading the areas between the potential curves and the pipe lines with red where the pipe is positive and with black or blue where it is negative to the rails, a clear representation of the potential distribution is obtained. If the negative bus-bar of the power station is connected to ground plates, or to other buried metal as cable sheaths, measurements of potential differences between these and the pipes should also be made and plotted upon a separate map.

It will generally be found that there are definite regions in the neighborhood of supply stations and of return feeder connections in which the pipes are always positive to the rails; and that there are other definite regions, remote from the first, in which the pipes are always negative to the rails. Between the positive and the negative regions the potentials will be found to fluctuate from positive to negative. The existence of potential differences between pipes and rails, even if large, is, however, no conclusive evidence of stray currents, but indicates at what points current may be flowing from rails to pipes and at what points it may be flowing from pipes to rails, or to other return conductors. A high potential difference is in fact usually a sign that there is a high ground resistance and consequently but a small current flowing.

The next step is to determine the direction of the probable current flowing in the pipes. This is done by measuring potential differences between two points in a pipe by means of a millivoltmeter. A convenient instrument for these measurements is a zero center Weston millivoltmeter, with two scales, one of 10 and the other of 100 millivolts. These measurements may be made between drips or service connections from 50 to 200 feet apart. These measurements cannot be used, however, for calculating the current strength in the pipes, but only to indicate the probable existence and direction of this current. This direction of flow is then marked upon the map, together with the potential readings.

In making these tests it is important that the connecting leads used with the millivoltmeter be rubber covered wires so as to have a good insulation and to prevent the wire, if coming in contact with wet ground, from taking the potential of the ground and disturbing the readings. A good wire for this is No. 14, rubber covered, and double braided wire. I remember one instance where we were measuring the drop along a cable sheath on a wet day, getting readings of from 1 to 2 millivolts; during one of these readings the needle suddenly ran off the scale, and a voltmeter which was substituted indicated 2 volts. We found upon investigation the connecting wire lying in water, the insulation defective, and that we were, therefore, getting the potential difference between the cable sheath and the surface of the ground instead of the drop in the cable sheath.

A study of the map will show at what points determinations of current strength should be made. This is done by measuring the drop in potential between two points in the pipe by means of a millivoltmeter, and dividing this by the resistance of the included length of pipe. If this length contains one or more joints this resistance must be measured, not estimated, because joints make contacts of extremely variable resistance. As this resistance measurement is troublesome to make, it is generally more convenient to measure the drop in potential between 2 points in one continuous length of pipe. A sketch of this arrangement is shown in Fig. 1. With very large pipes and

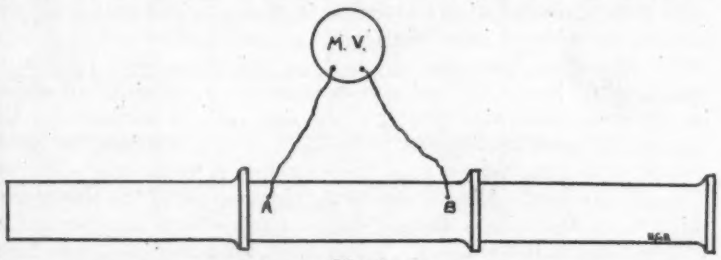


Fig. 1.

small current, this drop is a fraction of a millivolt and requires a specially sensitive millivoltmeter reading to hundredths of a millivolt for its measurement. The resistance of the length of pipe can be calculated from its dimensions and from an assumed figure for the conductivity. Mr. Maury, in a paper[1] before the American Water Works Association, has given convenient tables for converting drop in millivolts directly into amperes of current for cast iron and for wrought iron pipes. These tables are based upon a resistance of 0.00144 ohm per pound-foot for cast iron, and of 0.000181 ohm per pound-foot for wrought iron; these figures were obtained from measurements upon a large number of pipes and agree well with those given by others and with measurements made by the writer. To find the resistance of any cast or wrought iron pipe per foot of length, it is necessary to divide the above figures by the weight of the pipe per foot. In the accompanying table I have given the weights and resistances per foot for the usual sizes of cast and wrought iron pipes, the resistances being based upon the above figures for the pound-foot.

Weights and Resistances of Cast and Wrought Iron Pipe.

Standard Cast Iron		
Inside Diameter of Pipe. Inches.	Weight per Foot Without Hub. Pounds.	Resistance per Foot. Ohms.
½	....	....
1	....	....
1½	....	....
2	....	....
3	11	.000131
4	18	.000030
6	31	.0000465
8	42	.0000343
10	55	.0000262
12	70	.0000206
16	109	.0000132
18	130	.0000111
20	151	.00000955
24	205	.00000702
30	294	.00000490
36	408	.00000353
48	604	.00000238

1. "Surveys for Electrolysis, and Their Results." A paper read at the 23d Annual Convention, American Water Works Association, Detroit, Mich., June 23-24, 1903.

Weights and Resistances of Cast and Wrought Iron Pipe.

Standard Wrought Iron.		Extra Heavy Wrought Iron.	
Weight per Foot Without Hub. Pounds.	Resistance per Foot. Ohms.	Weight per Foot Without Hub. Pounds.	Resistance per Foot. Ohms.
0.84 ...	.000215	1.1....	.000164
1.7.....	.000106	2.2....	.000082
2.7.....	.000067	3.6....	.0000502
3.6.....	.0000502	5.0....	.0000362
7.5.....	.0000241	10.0....	.0000181
10 6.....	.0000171	15.0....	.0000121
18.8... .	.00000963	29.0....	.00000623
28.0....	.00000647	43.0....	.00000421
40.0.....	.00000452	54.0....	.00000335
49.0	.00000369	65.0....	.00000278

A matter of great importance in making these current measurements is to be sure to have perfect metallic contact between the pipe and the milli-voltmeter wires. It will not do to use drip or other fittings for this connection, but contact must be made directly with the metal of the pipe. It is, therefore, necessary to expose the pipe where a current measurement is to be made.

I have made tests with various methods of making contacts for current measurements upon a rusty pipe, and have found that the presence of oxide may produce such a high resistance as to prevent a reading. I have also found that moisture can produce an electro motive force due to electro chemical action so large as to entirely offset the reading due to drop by the current. A satisfactory method is to use a pointed piece of steel about half the size of an ordinary lead pencil, with the connecting wire soldered to it, and provided with a wooden handle, the soldered joint being inside of the handle; this steel contact is pressed against a spot on the pipe which has been previously filed bright. By far the best contact is, however, obtained by soldering the connecting wire directly to the pipe; this is particularly advantageous when readings are to be taken over a considerable time. This soldering should be done by means of a torch, and sufficient time allowed for the joint to cool to the temperature of the pipe before using it, as otherwise a thermo-electro motive force may be set up which disturbs the reading. When such contact wires have been soldered to a pipe it is convenient whenever practicable to continue these with rubber covered wires to the surface, or to some accessible point, and to terminate the ends in small iron boxes such as drip boxes. These wires are then available for future current measurements on the pipe without going to the labor of again exposing it.

These readings of current should be taken every 10 seconds for at least 10 minutes, and the maximum, minimum and average readings noted. By tracing the flow of currents found in the pipes from these measurements, points can be usually located at which current must be leaving the pipes, and the pipes should be exposed here and examined for evidences of electrolytic corrosion. It must be remembered that all current which is found flowing in a pipe must leave it somewhere in order to return to the negative pole of the generator. This follows from the fact that every electric circuit must be completely closed so that every ampere which leaves the positive pole of the generator must eventually return to the negative pole, no matter how long or complicated the path through which it passes may be. Electricity is in this respect very different from gas or water, which latter may escape from a leak and diffuse through the ground. It is for this reason that stray currents represent no loss of electricity to the railroad, as is sometimes supposed, but are on the contrary a gain, inasmuch as the ground and pipes offer additional return paths for the railway current and, therefore, mean less drop in the return circuit. It is for the purpose of taking advantage of the earth as a return conductor that railway power stations frequently use large ground plates connected to the negative bus-bar with heavy copper cables.

The previous brief outline of tests will serve to locate the points in the positive district in which there is the greatest danger from electrolytic corrosion, and these tests are relatively easily made and constitute the electrolysis survey as ordinarily made in America.

There may, however, be many other endangered points which these simple tests will not reveal. Stray currents do not always take the simple path from rail to pipe, along the pipe and back to rail or other return conductor, but frequently take roundabout paths, passing from one piping system to a second system, from this perhaps to a third system or passing across pipes, shunting around high resistance joints, etc., producing electrolytic corrosion at every point of leaving the pipe for ground. These points may exist in the negative, neutral or positive districts and are much more difficult to locate by means of electrical measurements.

The writer has in mind a striking case of this kind which he saw while witnessing some tests made by Mr. A. A. Knudson, in Rutherford, N. J. A water pipe crossing under trolley tracks was badly corroded, with all evidences that the corrosion was electrolytic, yet this pipe was always over 1 volt negative to the rails and, therefore, could not be giving up current to these rails. Upon further investigation it was found than an oil pipe crossed this water pipe several feet away in the ground, and that the water pipe was highly positive to this oil pipe. It was, therefore, clear that the current which was producing the corrosion was leaving the water pipe and entering the oil pipe.

Wherever there are two or more independent piping systems, as, for instance, water and gas pipes, measurements of potential difference between these should be made to see if any points can be located where current is likely to be passing from one to the other. Current measurements must then be made in the pipes at these points and plotted and studied as before.

Measurements of current should also be made at every point where a pipe crosses a trolley track or passes through particularly wet ground near trolley tracks to see whether current is passing from one to the other, as these are particularly endangered points. For this purpose it is best to expose a length of pipe on each side of the track and to measure the current on each side. It may be found, however, that this current is so fluctuating that it is difficult to draw conclusions from these readings; the passing of a car may produce an entire change in the current conditions. I have found that the best way to make the test under these circumstances is to use one milli-voltmeter in the pipe on each side of the track and to take simultaneous readings of current every 10 seconds for 10 or 20 minutes. The time of taking these readings should include the passing of a car. When these readings are plotted it can be seen, by comparing the current curves, whether there is a change in the current in the pipe where it passes under the track, and. therefore, if current is passing from pipe to rail or from rail to pipe at this point. The same method may be applied in any case where it is desired to find out whether there is a change in the current flowing in a pipe between any two points in the pipe. The illustration (Fig. 2) shows two such simultaneous current readings taken in a pipe on each side of a stretch of wet ground in which the pipe was laid for a distance of about 500 feet and only ¼ block away from the trolley tracks. The agreement of the current curves shows, however, that current was neither passing to nor from the pipe in this wet ground during the time of these tests.

A case where current was entering a pipe from wet ground is shown by the curves in Fig. 3, in which the simultaneous current readings are plotted, taken on each side of the wet ground through which this pipe was passing. The direction of the current flow was from Station A to Station B, the curves showing that, during most of the time of the test, current was entering the pipe from the wet ground between these stations.

In making these simultaneous current measurements it is very important that the 2 milli-voltmeters have the same period of oscillation, as otherwise, with the usual fluctuating current, one would lag behind the other in its reading and the instantaneous readings would no longer be comparable. It is desirable to use two exactly similar meters, and these should be strongly damped so as to move slowly enough to enable accurate readings to be taken even with a very fluctuating current. Another very important matter is the choice of time for making these measurements. The stray currents in the pipe will follow the load curves of the railway, and tests should be made at time of heaviest load as well as at time of light load. In a large railway system operating a number of stations, some of the stations may be shut down during periods of light load, and the current condition in the pipes be completely changed during these times. If the stray currents in the pipes are the combined leakage current from two or more railway systems, having different load curves, the current conditions in the pipes will also change during different times of the day, and perhaps also on different days. In cases of this kind a recording meter should be applied to a number of characteristic points in the piping system, arranged to record the current in the pipe. I have used a Wm. H. Bristol recording meter (a pyrometer instrument without its thermo-couple) to obtain 24-hour records of currents in pipes. The diagram in Fig. 4 shows the current in a gas pipe for 4 consecutive days, obtained from 4 Bristol charts by estimating the average current for consecutive 1 hour periods and plotting these averages. The records for other week days were about the same as shown for Monday and Tuesday, Fig. 4. The diagram for Sunday shows that the current in the pipe was very large and flowing prac-

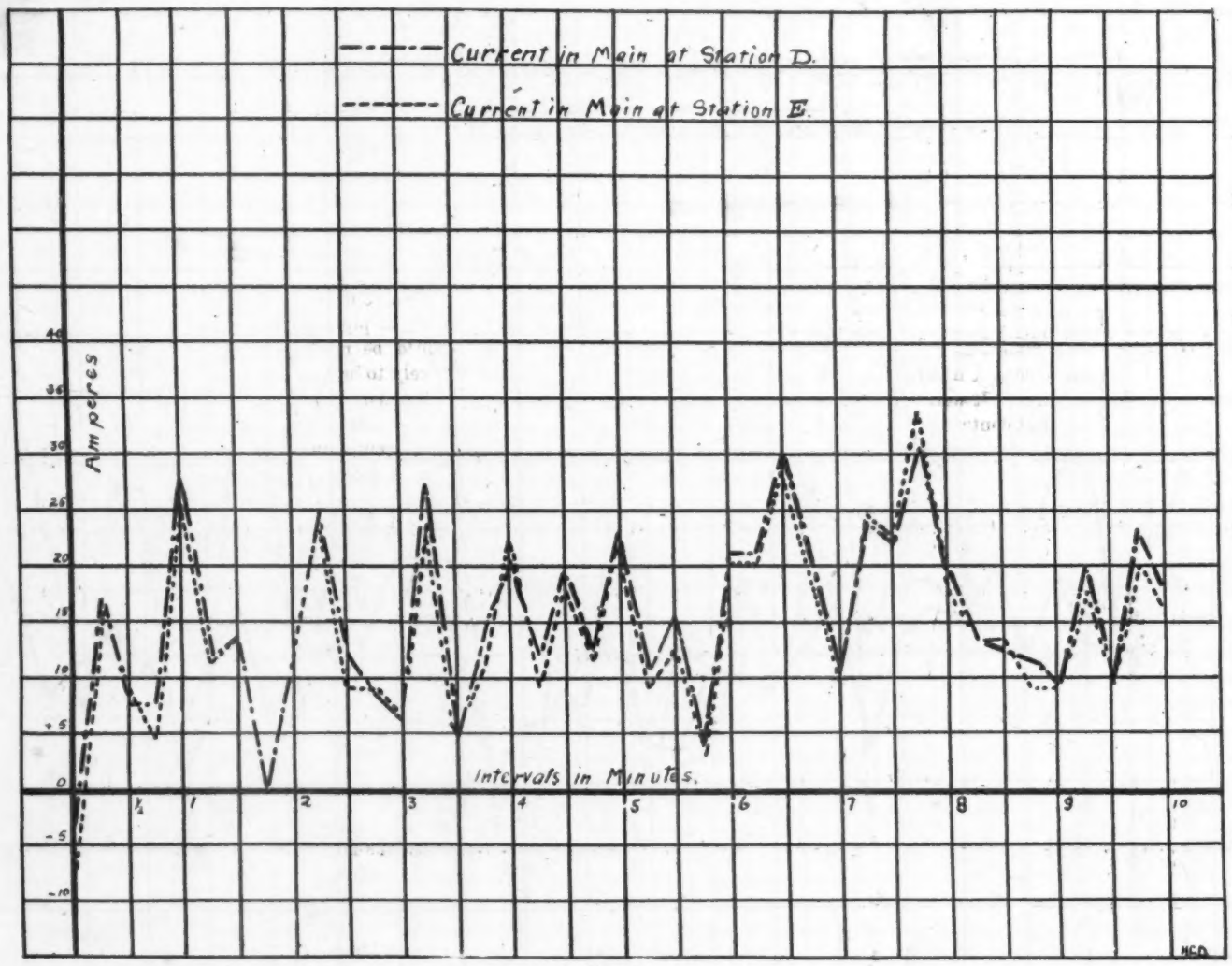


Fig. 2.

tically all day in the same direction; this large current is accounted for by the fact that the neighboring trolleys were carrying a large crowd of Sunday excursionists. The following Sunday was a rainy day, and the record showed a much smaller current in the pipe for this day. I want to say that the change in direction of the current indicated in the weekday diagrams is an unusual condition, and probably due to the changes in the operation of the power houses producing the currents affecting the pipes. These current records, by their agreement with the load curves of the trolley road, are frequently also useful in serving as evidence that the currents in the pipes are trolley road currents. As the electrolytic damage is proportional to the time during which the current acts, it is necessary to have the time curve of current in order to estimate the probable destruction. One ampere leaving an iron pipe for wet soil will remove 20 pounds of iron in 1 year; but the same ampere of current in its path through the ground and pipes may leave the pipe and return to it any number of times, shunting for instance around occasional high resistance joints, and removing iron at the rate of 20 pounds per year at every point of leaving the pipe. The actual damage is also very much dependent upon whether the exit of current is concentrated in a small area or is distributed over a large area. Experience shows that the electrolytic corrosion ordinarily takes place in spots producing pittings in the pipes, which indicate that the current must leave the pipes in these spots and not from the entire surface; the pipes are in this way much more quickly destroyed than if the corrosion took place uniformly over the entire surface. It, therefore, is an extremely difficult matter to estimate the amount of electrolytic damage, and such estimates will generally be too low for the above reasons.

It is possible to trace the path of current through the ground by measuring potential differences between different points in the ground. An iron rod driven into the ground is often used for making contact for such measurements. This, however, is not reliable, because the electromotive force of polarization of the iron in wet ground is dependent upon the surface condition of the iron and upon the ingredients of the ground; it is not constant, and necessarily the same for each 2 rods in different parts of the ground. Where small potential differences are measured between 2 points in ground, by means of iron rods as electrodes, entirely wrong results may be obtained because of difference in the polarization voltages at the two electrodes.

To overcome this difficulty the "non-polarizable" electrode shown in Fig. 5, was devised by Prof. Haber. This consists of a glass tube, about 2 inches in diameter and 10 inches long, having a porous cup cemented to one end, and containing a saturated solution of zinc sulphate with a zinc rod dipping into the solution. The porous cup is pressed against the part of the ground at which the potential is to be measured, establishing contact between the ground and the zinc sulphate solution. There is only a negligible polarization voltage between the zinc sulphate and ground. The zinc is this solution has a definite and constant polarization voltage with reference to the solution. When two of these electrodes are used to measure the potential difference between two points in the ground, the two polarization voltages balance each other. With these electrodes a zero method, such as a potentiometer with a sensitive galvanometer, should be used for measuring the potential differences, because the high resistance of the contact through the porous cup would produce a drop in voltage and reduce the reading on a direct reading voltmeter. This non-polarizable electrode is also used to measure the potential difference between a pipe or rail and the ground. In this case the polarization voltage of the electrode must be taken into account, which is equal to 0.45 volt negative with reference to the iron of a pipe or rail. This means that, without current flowing between pipe and ground, the potential difference between an iron pipe in ground and this electrode placed nearby in the ground would be 0.45 volt, the pipe being positive. If, then, a measurement shows the pipe, say, 1.1 volts positive to the electrode it means that the pipe is $1.1 - 0.45 = + 0.65$ volt (positive) to the ground, and proves that current is flowing from the pipe to the ground. If a measurement shows a pipe, say, 0.15 volts positive to the electrode, it means that this pipe is $0.15 - 0.45 = - 0.3$ volt (negative) to the ground, and proves that current is flowing from the ground into the pipe. Ground potentials of less than 0.1 volt cannot safely be used as evidence of current flow as they may be due to accidental causes.

It may be desirable to measure directly the flow of current through

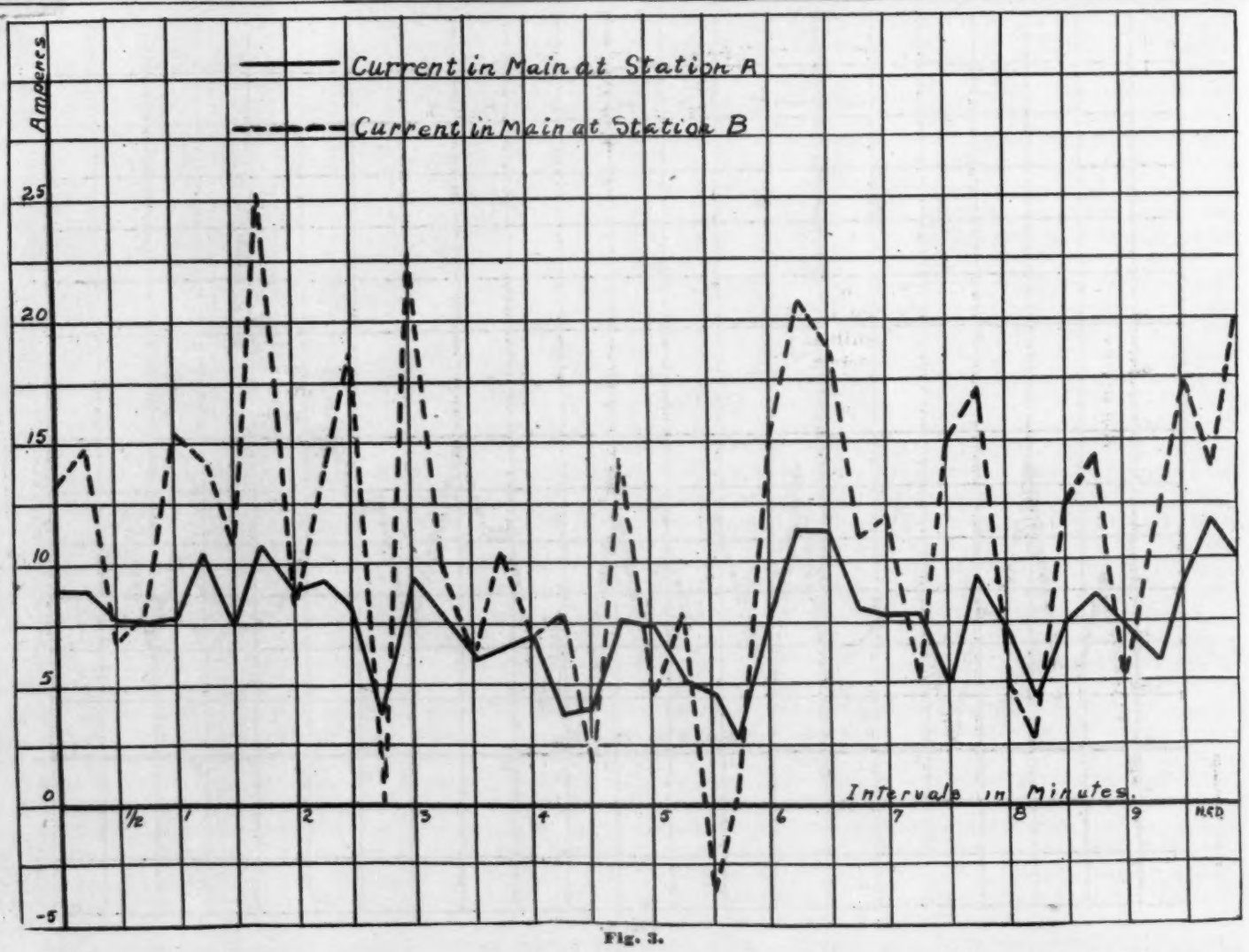


Fig. 3.

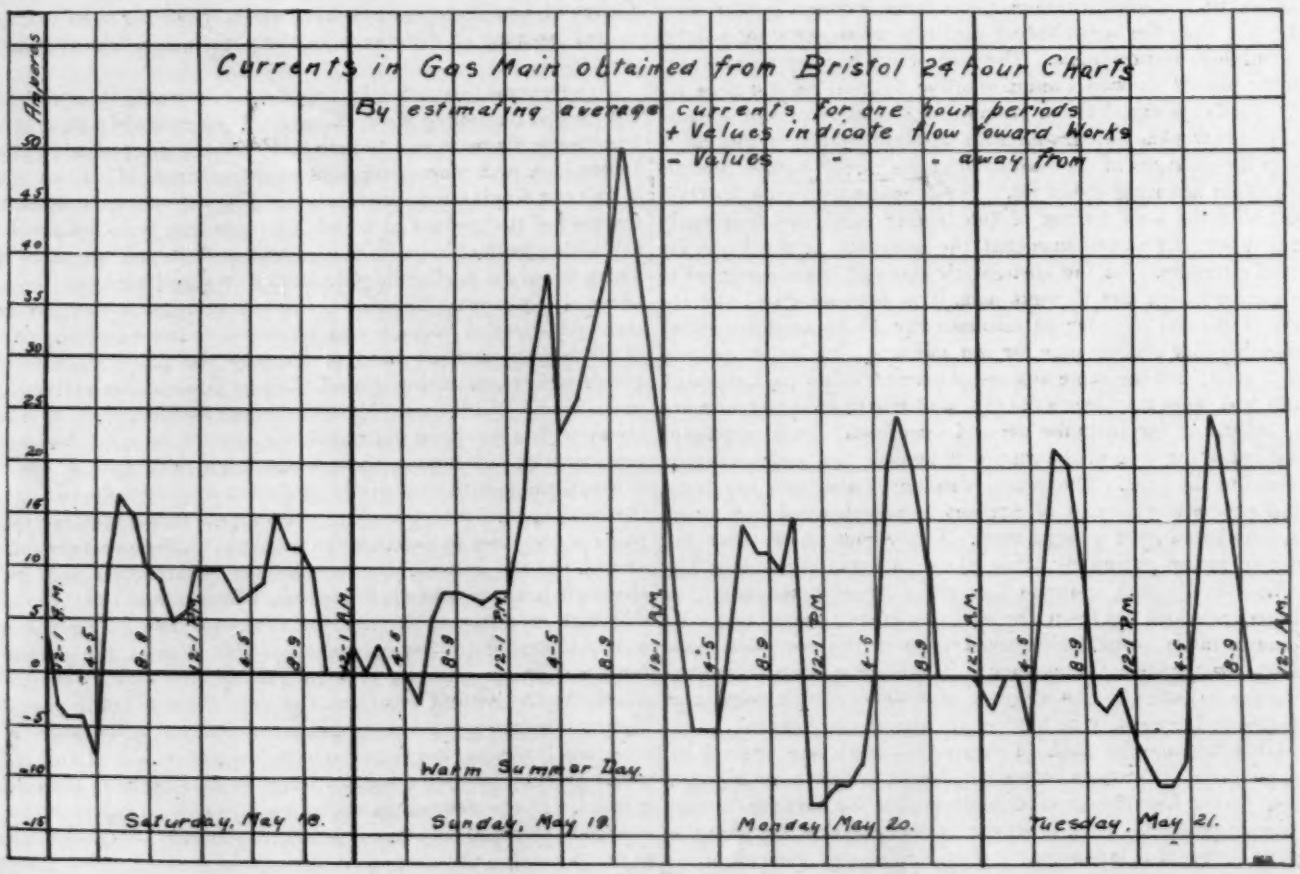


Fig. 4.

ground, as between a pipe and a rail, or between two pipes. The best arrangement for this is the "earth amperemeter," devised by Prof. Haber and illustrated in Fig. 6. This consists of a wooden frame with 2 copper plates about 4 inches square, and separated by a plate of mica or glass, as shown in the figure. These copper plates are covered with a layer of paste made of copper sulphate and water with 20 per cent.

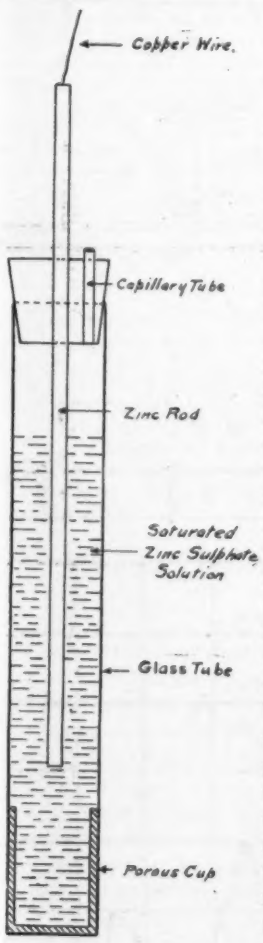


Fig. 5.

sulphuric acid, the thickness of paste being about $\frac{1}{16}$ inch. A wetted piece of parchment paper is laid over this paste and the remainder of the frame is filled with soil taken from the portion of ground where the current is to be measured. This frame is then placed in a suitable excavation in the ground where current is to be measured, so that the current flow is as nearly as possible normal to the frame, and the latter is then completely covered up, the soil being tightly tamped in. Insulated copper wires are brought out from the plates and connected with a milli-ampere meter; this will indicate the current flowing through this section of the ground. The object of the copper sulphate paste is to prevent polarization at the surfaces of the copper plates, which otherwise would produce an electromotive force opposing the flow of current through the meter. The direction of the meter indication will give the direction of the current flow through the ground. It might be supposed that the introduction of this frame would entirely change the current conditions in the ground. This has not been found to be the case, due to the fact that the resistance of the path through the ground is very high. The displacement of the small portion of ground taken by the copper plates, therefore, does not greatly change the total resistance of the path of the current through the ground. The notion that the earth is a conductor of negligible resistance applies only when the path of the current is through an unlimited cross section; the resistance of a limited section of earth is comparatively high, varying under ordinary conditions from 100 to 1,000 ohms between opposite faces of a cubic foot.

This earth amperemeter is well suited for measuring current flow between pipe and ground. For this purpose the frame is buried in the ground from 1 to 2 inches from the pipe, and parallel to the pipe and normal to the probable current flow through ground. This measurement can be used to form an estimate of the probable amount of electrolytic damage to the pipe, and in cases where corrosion has taken place it will serve as evidence that it was caused by stray currents.

I have made a number of laboratory tests with the non-polarizable electrode and the earth amperemeter and have obtained exceedingly satisfactory and consistent results.

I want to call attention to a wholly incorrect method for determining current flow between pipes and rails through ground, which I have seen described in a certain class of electrolysis reports. I refer to the method in which the potential difference between a point in the rails and a point in the pipes is measured with a voltmeter, as between *C* and *D*, Fig. 7, and the resistance between these same points is measured with an ohmmeter. The voltage divided by the resistance is given as the current in amperes flowing through the ground. This is then repeated for other points, as *E* and *F*, *G* and *H*, etc. (Fig. 7), and these currents are added up to give the total current through the ground. In one published report of this class upon a water piping system in a Western city, this total current is given as 6,148 amperes, with a calculated destruction of 122,980 pounds of iron per year. The following words of warning are found in this report: "The loss of 122,980 pounds of metal per year from the distributing water system must eventually bring great and serious trouble, involving the expenditure of many thousand dollars."

The absurdity of these figures is clear when we consider that many times this current could have been obtained by making tests in a sufficient number of additional points in the system. Current through ground between pipes and rails cannot be determined from such measurements of potential difference and ground resistance. The latter is the joint resistance of all conducting paths between the entire piping system and the entire rail system, while the potential difference is that between a point in the pipes and a point in the rails; these two measurements can, therefore, not be combined by Ohm's law to give current, and the figures which have been given in the reports referred to are entirely without meaning; the results and conclusions based upon them are consequently wholly untrue.

As an example of the wholly incorrect conclusion which this method may lead to I have shown, in Fig. 8, the instantaneous values of current measured in a gas pipe at stations on each side of a stretch of ground soaked with salt water, taken simultaneously with potential readings between this pipe and trolley tracks close by and in contact with this wet ground. The gas pipe is seen to be about 1 volt (average) positive to the rail. The resistance between the rails and pipe must be very low, so that a current calculated by the above method would give a large value and lead to the conclusion that this current was passing from the pipe to the wet ground and producing corrosion. The simultaneous current readings show, however, that there is practically no escape of current from the pipe between these stations. This class of report is generally also full of remarkable statements

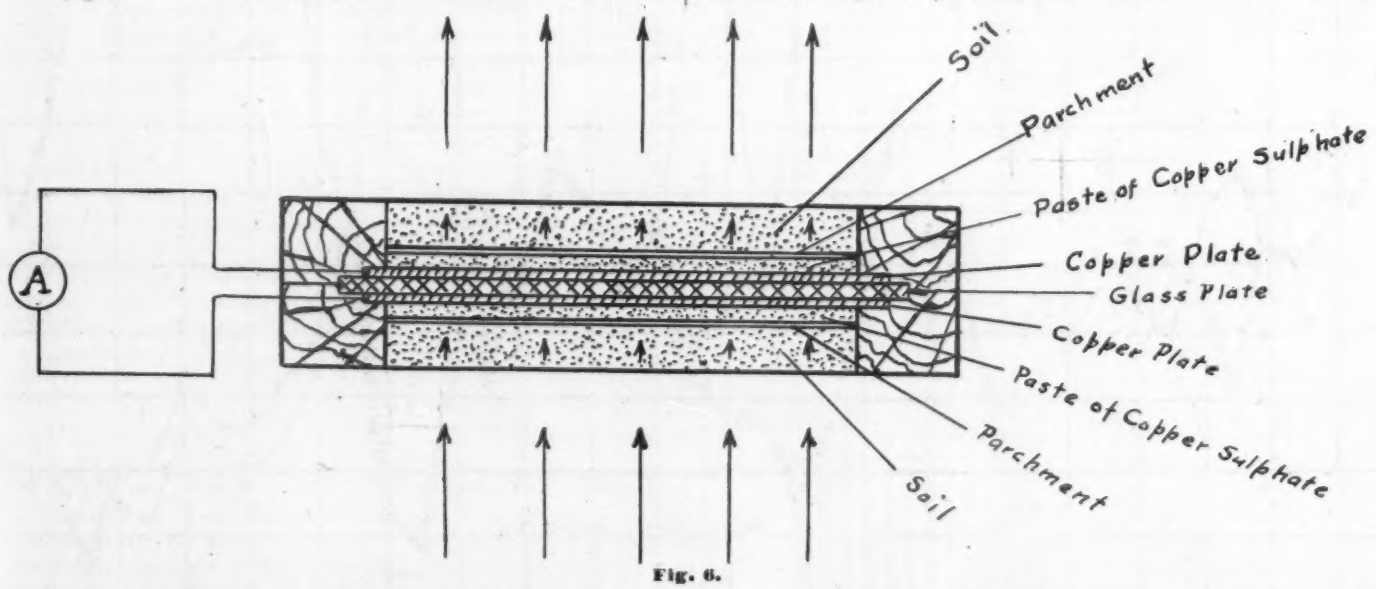


Fig. 6.

which greatly exaggerate the electrolysis danger and which seem to be designed to scare people against the electrolysis evil. From the absurdity which appears on the face of these reports they tend to hide the real electrolytic conditions and the real dangers which exist. The technical press has already exposed and severely criticized some of these reports which have been published.

Where more than one electric road is operating in the vicinity of a piping system, the stray current in the pipes may be the leakage current from one, or it may be the sum of the leakage currents from all of the roads. In cases where electrolytic damage has resulted it is important to trace and prove the source or sources of the destructive current in order that claims for damages and a demand to stop this current may be presented to the proper owners, and pressed in court if necessary. This is fairly simple if it is possible to disconnect each power house in succession for an interval sufficiently long to measure the effect upon the pipe current. If this cannot be done indirect methods must be used which may make the problem very trouble-

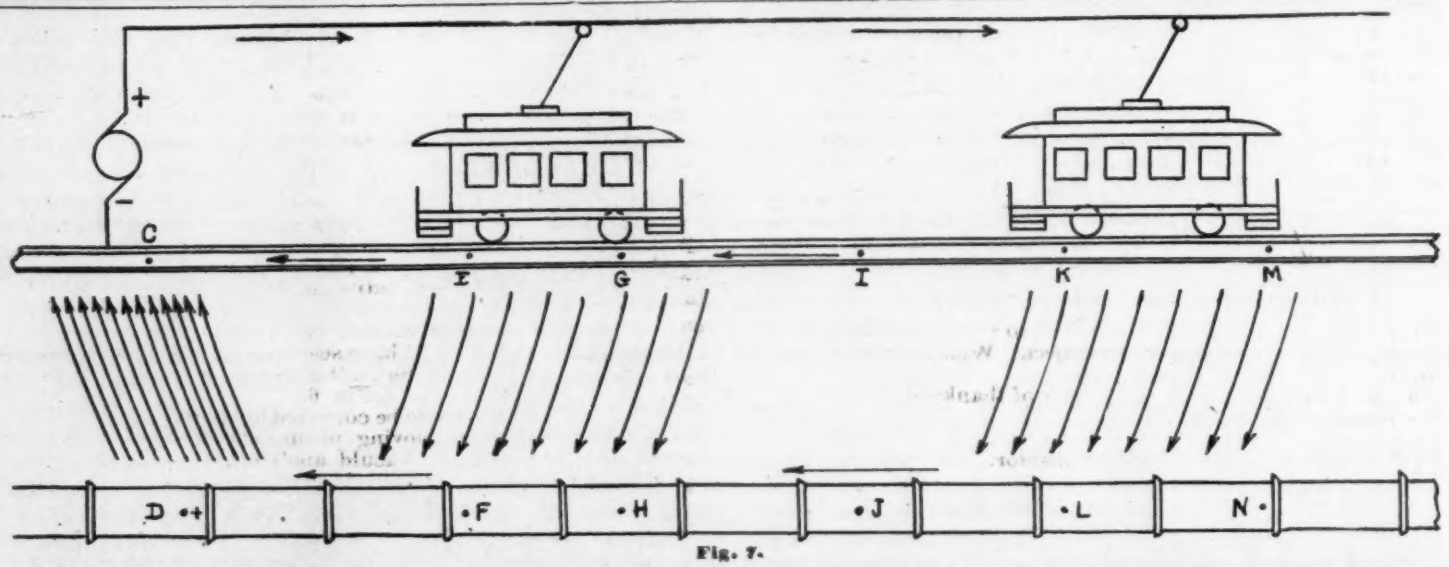


Fig. 7.

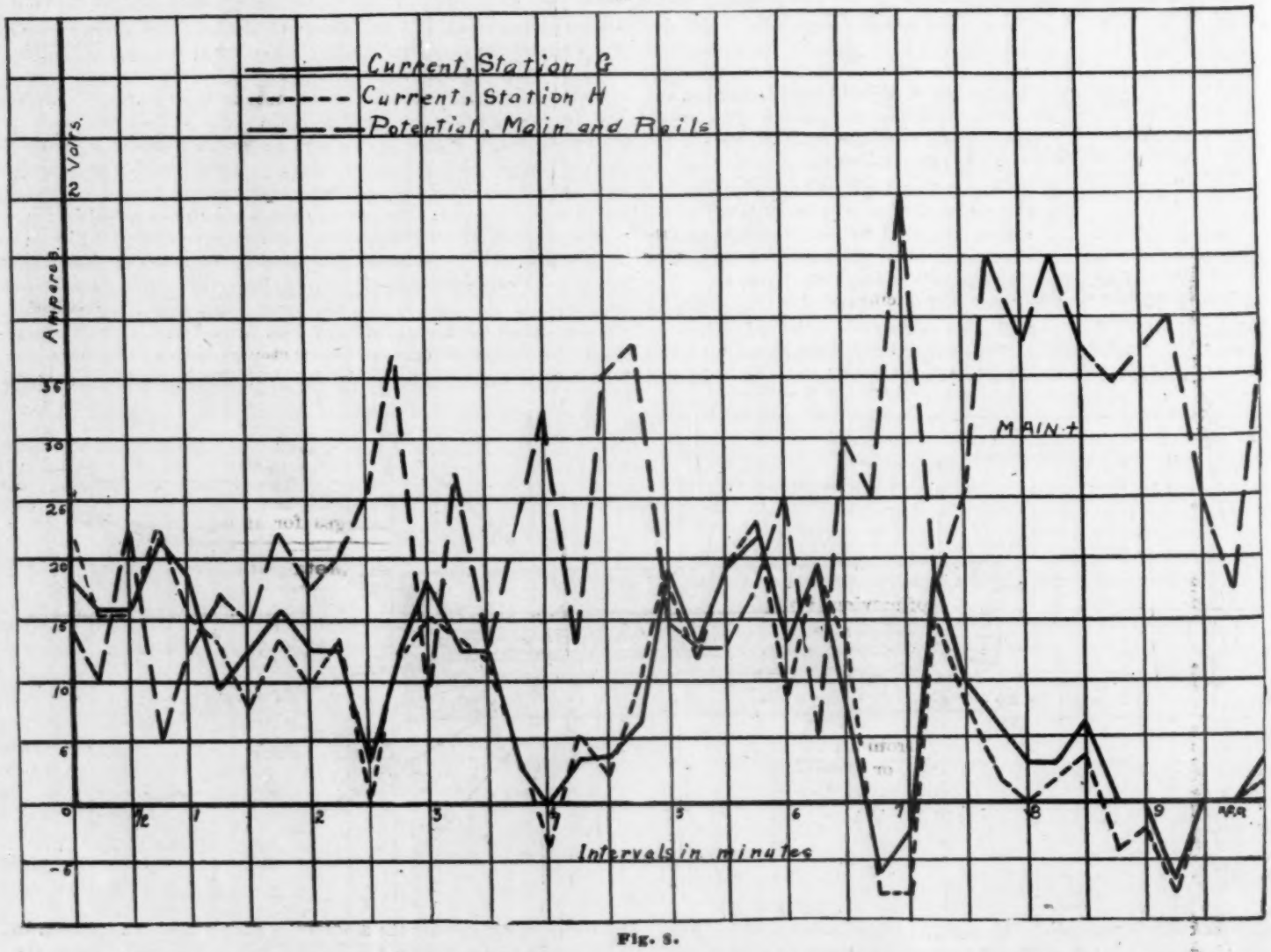


Fig. 8.

some, especially in cases where two or more roads use a common track for part of their line. Noting the starting, running and stopping and location of the cars on each line, and comparing this with the current curves in the pipes, will often help to locate the source or sources of the pipe current. Where the tracks of the different roads are independent, a good method is to attempt to measure the current flowing through the ground between pipes and the rails of each system by means of the earth amperemeter. No universal method can, however, be given because the conditions vary so widely; it is necessary to study each case separately and to adopt the methods best suited to it.

Of the attempted remedial schemes the one most frequently applied to pipes in America is bonding in the positive districts to the negative bus-bar. While affording local protection, this greatly increases the amount of stray current, frequently producing electrolytic trouble in other portions of the piping system, as at joints, and the pipes themselves become a source of danger to other underground metal. In cases where there are variations in current flow, as was, for instance, illustrated in Fig. 4, no bonding scheme can be applied, as the positive zones keep shifting about.

Insulating joints can only be used in special cases to effect a partial reduction in the stray currents in the pipes, and often do more harm than good.

I am convinced that in most cases there is but little, if anything, that the pipe owner can do to protect his pipes from these stray railway currents. The cure must and in all fairness should come from the railways. This is the attitude which the Germans have maintained ever since they have begun to study this problem.

The question of the proper restriction to place upon the railroad in order to render underground piping reasonably safe from stray cur-

rents is a hard one to settle. In some places a maximum permissible potential difference in the rails, or between rails and pipes, has been prescribed. The amount of stray current depends, however, just as much upon soil resistance as upon potential difference, and this resistance varies so largely that no maximum, safe voltage can be prescribed for all cases, except one so low as to be entirely impracticable. The maximum allowable current in any one pipe is sometimes prescribed; this, however, is also inadequate. The only really safe condition would be a maximum allowable density of current leaving any one pipe for ground, expressed in milli-amperes per square foot of pipe surface. This is, however, troublesome to measure, and the restriction would be very difficult to enforce.

A Hearty Vote of Thanks.

The President—We have just listened to a very interesting and most able address on a most important subject. What is your wish respecting it?

Mr. McDonald—I move a hearty vote of thanks to Dr. Ganz for his excellent lecture. [Seconded.]

A Member—By rising vote, Mr. President.

The President—A rising vote is called for. All those in favor will please arise. It is a unanimous vote.

Dr. Ganz—Mr. Chairman and Gentlemen, I thank you most heartily for this vote.

[To be Continued.]

House Gas and Moving Picture Machines.

[Communicated by "R."

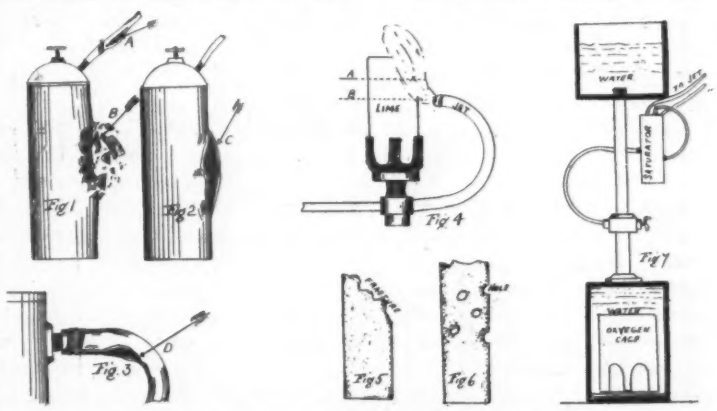
The general introduction of moving picture machines throughout the country has increased certain lines of business in the gas lighting industry, and gas men have often been obliged to fit up departments, in connection with their regular establishments, solely for the purpose of attending to the needs of the moving picture machine men. In fact, in some of the cities and towns the gas manufacturers are doing an exceedingly profitable line of business with the animated picture machine men. The call for supplies from the gas men from the picture men began, of course, with the demand for house gas for filling the hydrogen cylinders of the calcium or lime light outfits of the moving picture lighting plant. While the electrical arc light is extensively employed in furnishing the illumination for the moving picture machine, many thousands of the machines are necessarily operated in towns and other places where no electrical current is available. Consequently, in order to produce pictures, artificial gases are used. For moving picture purposes it has been found that, by burning hydrogen and oxygen gases together on a lime, that a very brilliant light can be obtained, of ample volume and density to throw moving pictures clearly. There are dozens of different methods of getting the gases.

Some of the travelling moving picture showmen carry complete apparatus for the making of the two gases. Others have patented devices for making the gases from cakes of previously prepared oxozone. There are mixtures of carbide gas lights and oxo-gases, and others with special names applied. The gas manufacturers are appealed to often for the house gas for filling the tanks necessary for this part of the light. Some of the gas makers have fitted up offices or rooms in which a line of picture machine tanks is carried. The hydrogen gas is pumped into the cylinders direct from the retorts, and the oxygen gas is either made in separate tanks, or handled on the commission plan for some of the calcium light gas makers of the locality.

Rather than use house gas, some of the picture machine men make their hydrogen gas from ether or gasoline, in a saturator, and often the gas companies are supposed to carry the kinds of oil and ether needed for this purpose. The saturator is not always as perfect in construction as it should be. It is often made small and then, when the contents are exhausted, popping and bursting may arise either in the pipes or in the saturator itself. If the explosion happens in the pipes the latter are simply opened and no great damage is done; but if the explosion occurs in the saturator, the pieces may be blown out, as at *B*, Fig. 1, and cause considerable damage. In order to avoid this trouble the majority of saturators are now made of soft metal. At *A*, Fig. 1, is shown a split in the pipe due to popping at that point. In Fig. 2 at *C*, is shown the way a soft metal saturator bursts. Not much harm will result, as there are no pieces to fly about. Before starting up the gas outfit it is best to look over the rubber tubes that connect the nipples. Often the tube will split, as at *D*, Fig. 3. Some of the tubing furnished the picture machine men is exceedingly inferior in grade and it will break open very readily. I have seen tubing that was wound with cords and light wire. The picture men are getting in the habit of looking to the gas companies for this tubing, as well as for the supplies for making the gases. Furthermore, the gas manufacturers who have introduced side lines of gases and supplies to accommodate the moving picture men have been obliged to give instructions to beginners. The beginner has plenty of trouble with his calcium light at the outset. He does not allow time for the two gases to burn steadily on the lime. He expects the lime to get to white heat too soon. Sometimes it takes 15 minutes' time to get the lime heated to that degree. Meanwhile he exerts himself on the lenses and other parts of the machine, but poor light is obtained and an inferior picture too. The jet point is often too far from the lime; about ¼ inch is enough. I usually get the point of the jet on the line *B*, Fig. 4. If at line *A* there will not be quite enough of the lime exposed for making a full heating point. I now take plenty of time. In fact, I light up 20 minutes ahead of time and let the lime heat red and on to the white heat. Then I begin adjusting the lenses and get the picture right.

I have seen men struggle with an old lime, fractured off as at the designated point in Fig. 5. I have seen limes in use bored with holes by the gas jet burning too long on that particular point on the lime, resulting in imperfections, as in Fig. 6.

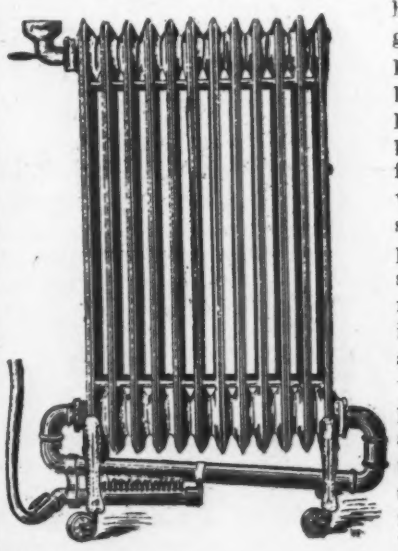
Many of those evils have to be corrected by the gas makers of to-day who are situated in the moving picture show districts. It is but natural that the picture men should apply to gas men for materials and professional advice. Of course, there are many kinds of devices constantly coming to notice. One of these is shown in Fig. 7. The



oxozone is placed in a basket in the lower tank and oxygen gas is generated by contact with water. The ether or gasoline in the saturator makes the hydrogen gas and the two gases combined produce the limelight. The device is not large enough or strong enough. It will keep a light going only a trifle over an hour, owing to the limited capacity, and many similar devices are being introduced. They look nice and are finished well; but they need tinkering, and the gas men are the ones who have to do much of this repair work. Such work is profitable, even if it must be very often done in a hurry. The show may be on and the tubes or fixtures give out. The repairs are needed hurriedly, so such work is charged for at high prices, wherefore the revenue is good.

Gas Heated Sheet Metal Hot Water Radiator.

The apparatus herewith illustrated, which is being put on the market by the Portable Radiator Company, looks good to us. It is a portable radiator built of sheet metal, gas being employed as the fuel to heat water circulated through the tubes. As can be understood from an inspection of the cut it is a complete outfit of a hot water heating system all in one, the gas burner, which can be supplied with gas from a nearby pipe connection, taking the place of a heater, the radiator proper performing the usual functions of the radiator, the water piping joining the opposite ends of the radiator and passing over the gas flames, serving as the water circulating mains. Besides its convenience in being placed where wanted and being capable of removal when the heating season is completed, it is felt that one has the advantage of the hot water system without the necessity of installing a system of piping mains and branches and of having a hot water boiler in the basement. The radiator is mounted on casters, and can be wheeled from one room to another by simply making a rubber tubing connection with either artificial or natural gas. The radiator having 40 square feet of heating surface holds 60 pints of water, and t is stated that 20 minutes after the gas has been lighted the water is



heated to a temperature of 170°. The burner is the blue flame type, and when turned on full requires 10 cubic feet of gas per hour, though it is explained that after the water has become heated only half the amount of gas is necessary to keep the radiator warm. A 40 square feet radiator weighs about 100 pounds, and its portability gives it a field for bathrooms, halls, inclosed porches or rooms where heat is not available. The radiator is made in sizes ranging from 20 to 60 square feet of surface.

Incongruities in Specifying Amounts of Illumination.

The *Gas World* notes that Herr Berthold Monasch, of Berlin, recently delivered some trenchant observations upon the incongruities of our different ways of speaking in regard to matters photometrical. The successive congresses of 1881, 1882, 1884, 1889, 1893, 1896 and 1900 reached no conclusion as to the adoption of an international unit of intensity of light. Germany holds to its Hefner unit, France to its Carcel, and England to its candle; and the 1903 meeting of the International Photometrical Committee gave up the attempt and contented itself with setting on foot inquiries with a view to ascertaining the relation between these units, inquiries which have resulted in the data adopted by that committee at their meeting in July, 1907, in Zurich.

One point is that in Germany the expressions "lux" and "meter-candle" are used as synonymous terms. But this is wrong. The old "meter-candle" was derived from the old German paraffine standard candle (in use up to 1897), which was equal to 1.2 Hefners. Accordingly, when Cohn announced in 1885 that the least intensity of light suitable for reading was "10 meter-candles," and the least at which one need not strain the accommodation of one's eyes more than one would by daylight was "50 meter-candles," it does not do now to carry over these expressions into the present day or to express them as 10 and 50 luxes, respectively; we must say 12 luxes, or 60 luxes, in order to express what the distinguished ophthalmologist really meant.

The next is that at the present time anyone following up the international literature of the subject has to become acquainted not only with the lux and its false synonym the meter-candle (which always suggests an inquiry whether the "candle" referred to is the old candle or the modern Hefner-candle), but also with candle-feet, candle-meters, carcel-meters, bougie-meters, Hefner-feet, Hefner-meters, to which we may expect will be added such things as a Russian Carcel-Arschin and a Japanese Hefner-Yin before very long; and on these we have variations, such as candle-feet and foot-candles, to increase confusion. All these words are open to the objection, as Mr. Clayton H. Sharp has pointed out, that double words of this kind really mean products, in scientific terminology; and these things are not products. For example, "meter-candles" is short for "number of candles divided by square of number of meters," not for "meters multiplied by candles." Adherence to a single term is far better; and these variations make it very difficult to follow the current literature of the subject, especially since we have to go beyond the intensity and have to consider the amounts of illumination at particular points. We cannot nowadays compute these by the simple law of inverse squares, treating all our sources of light as mere points. Our sources have become complex and the effect is now made to depend greatly upon globes and reflectors. The result is that we have to measure the actual illuminations produced in various directions. Full moonshine produces an illumination of 0.10 to 0.16 lux; 12 luxes are required to enable us to read and 60 luxes to read comfortably; from which knowledge a guess may be made as to the amount of illumination in any particular case. But if we read that moonshine in America has an illuminating value of 0.015 to 0.030 candle-foot we do not know what is meant; and the value of 1 candle-foot as being the minimum required for reading gives us no information. If we had only to do with luxes and candle-feet we would learn to understand the two; but when there are so many methods in use, even in one and the same number of a technical journal, the difficulty becomes too great. One and the same physiological phenomenon should be expressible the world over in one and the same manner.

An Aid to Understanding.—Meantime the only way out of the difficulty is to work out a table (using the Zurich 1907 official comparative values of the various sources of light) showing the relation between the different modes of expression of the same thing.

Suppose, for example, we read that the minimum illumination in street lighting should be 0.35 lux; we want this in candle feet. Go

If Data are Given in	And are Required in					
	1 Luxes.	2 Hefner-Feet.	3 Candle-Feet.	4 Candle-Meters.	5 Carcel-Meters.	6 Bougie-Meters.
	Multiply by					
1. Luxes (Hefner-meters)	1	0.0929	0.0848	0.9132	0.093	0.8849
2. Hefner-feet	10.76	1	0.9132	9.84	1.001	9.52
3. Candle-feet	11.78	1.095	1	10.76	1.097	10.43
4. Candle-meters	1.095	0.1016	0 0929	1	0.1018	0.969
5. Carcel-meters	10.75	0.9986	0.9115	9.817	1	9.513
6. Bougie-meters	1.13	0.105	0.0958	1.031	0.1051	1

then to vertical column 3; and as the datum is given in luxes, we find the required multiplier in the first line of that column. It is 0.0848, and on multiplying 0.35 by 0.0848 we get the answer 0.0297, or, say, 0.03-candle foot. But even this does not get over all the difficulties that are occasioned by the want of uniformity. What is the candle? The Standardization Rules of the American Institute of Electrical Engineers say that Hefner : candle :: 88 : 100; the Zurich Committee define the candle as the 10th part of the pentane standard, and then the Hefner : "candle" :: 91.32 : 100; but Paterson has shown that the British spermaceti standard candle is some 5 per cent. below the 10th part of the pentane standard; so that there will henceforth be two values of the "candle foot" to discriminate and disentangle.

The "bougie" referred to in column 6 of the table is the bougie-décimale, $\frac{1}{20}$ of the Violle platinum standard.

International uniformity of practice in specifying illuminations is, therefore, a great desideratum, and measurement in luxes seems quite appropriate.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE selling rate at Bath, Me., has been put at $1.50 per 1,000 cubic feet. Special prices are given under certain circumstances.

"W. V.," writing to us under date of the 9th inst.: "To many residents of Walla Walla, Wash., it seems that a decided mistake was made by the Northwestern Gas and Electric Company when it accepted the resignation of Mr. Robert Allen as Local Manager. People out this way liked Allen very much, and they are surely going to see that his wholesale coal business pays him at least as good a financial return as did the salary given him by the bunch of Spokane—capitalists shall I call them?—who control the gas supply of our own Walla Walla."

MR. O. G. F. MARKHUS has actively assumed the duties of General Manager to the Capital City Electric Light, Motor and Gas Company, of Boise, Idaho.

MR. T. C. BRADLEY forwards the following from Milwaukee, Wis., under date of the 10th inst.: "A reduction in the gas rate has been ordered by the West Allis and the Wauwatosa Gas Company; both places are really suburban districts of Milwaukee. The rate schedules are: For the first 10,000 cubic feet used during any one month, $1 per 1,000; any amount over 10,000 cubic feet, up to 20,000 cubic feet, used during the same month, 90 cents per 1,000; any amount over 20,000 cubic feet and up to 30,000 cubic feet, used during the same month, 80 cents per 1,000; for all additional consumption over 20,000 cubic feet, used during the same month, 60 cents per 1,000."

AT the annual meeting of the Omaha (Neb.) Gas Company the officers chosen were: Directors, Frank T. Hamilton, James T. Bodine, Geo. E. Barker, Geo. E. Pritchett and Geo. W. Clabaugh; President, F. T. Hamilton; Vice-President and Secretary, G. W. Clabaugh; Treasurer, Isaac Battin; Asst. Treasurer, Lewis Lillie; Asst. Secretary, James Bell; Engineer, Isaac Battin; Superintendent, George W. Waring.

THIS message from Milwaukee, Wis., which carries date of the 6th inst., rather bears out the excellent paper read by Mr. T. J. Litle last week before the Commercial Gas Engineers Association, on the subject of "Gas Illumination and Shop Practice." The message is: "An investigation was recently set on foot to ascertain why so many operators of large factories who had installed individual electric lighting plants had abandoned these, replacing the outfits, as a general practice, with gas arcs, mainly of the Humphrey type. The impelling reasons were: First, the illumination obtained was secured at a price very much lower than from arc or incandescent electrics; second, the illumination received was of a quality and volume unobtainable from any other lighting medium. The character of the

work in most factories is such that it is impossible to properly carry it on at all unless the work rooms are well lighted. The nearer the approach to daylight the more and the better the quality of work that can be turned out, so the result is a saving in operating costs. It has been found that, under the old method of lighting factories, night shifts produced 20 per cent. less output than day shifts. By fairly reproducing daylight conditions, it has been found possible to wipe out this difference. Manufacturers have found that to approximate these daylight conditions, absolutely no other lighting appliance they have been able to discover has accomplished the results obtained by the gas arc lamp, of which the Humphrey type was and is the leader."

L. R. WILGUS is informed that the present address of Mr. Stanley J. Lowe, is Clarksville Gas Company, Clarksville, Tenn.

THE output of gas in Holyoke, Mass., for the year just ended, shows an increase of 20 per cent. over that sent out during 1906.

THE Dauphin County Gas Company, of Steelton, Pa., reports great activity, the outlook on range account being especially promising.

UNDER the Bay State Gas Company settlement the income bondholders are to receive par and $70 for each $1,000 bond presented for cancellation.

THE proprietors of the Wooster (O.) Artificial Gas Company inform us that they have no intention of closing down the works. On the contrary, the statement is made by them—and was so published in the local papers—that "The Artificial Gas Company will be in Wooster when there is no natural gas." To which we add, "We hope so."

WHILE there was no set exhibition of gas apparatus and appliances at the New York meeting of the National Commercial Gas Association, it is neverth eless a fact that several individual exhibits were shown. Notable among these was that of the Bristol Company, which display attracted much attention and evoked considerable favorable comment. The display, which was under the very capable direction of Mr. W. W. Patrick, Manager of the Company's New York office, included handsome working specimens of the Bristol folks newly developed, moisture-proof recording gauges and standard form instruments, examples of which may be found in every part of the country where gas works are sustained. The listings also covered working examples of the Company's new types of portable recording gauges and voltmeters.

MR. PAUL C. KARCHER has been appointed Purchasing Agent of the Youngstown (O.) Gas and Electric Company.

"A. C.," writing from St. Louis, under date of the 10th inst., says: "Some time ago, during the absence from the city of Mr. A. F. Blossey, Supt. of Works, Alton (Ills.) Gas Company, something went wrong with an ammonia still, and the hands were considerably worried. Mrs. Blossey, hearing about the state of affairs, went to the works, inspected the still, issued a few instructions, and all was well. Mrs. B. is a graduate of the Lawrence University, of Appleton, Wis., and prior to her marriage was a teacher of physics in a Wisconsin high school."

"B. S," writing under date of the 11th inst., inclosed this interesting budget: "At Wilkes-Barre, Pa., and Moline, Ills., two 500,000 cubic feet capacity gasholders of similar design are among recent improvements made by the Wilkes-Barre Gas and Electric Company and the Tri-City Railway and Light Company, respectively, in charge of the J. G. White & Co. Corporation, of New York, as operating managers. The holder at Wilkes-Barre has just been placed in service, and it is expected that the Moline holder will be completed forthwith. In each case the installation has been necessitated by heavy increase in business resulting from active selling campaigns by the management. The holder at Willes-Barre is the largest one in northeastern Pennsylvania. It is built on the bank of the Susquehanna river on a rock shelf, and is protected from floods and ice by a timber, rock filled crib, built along shore. The crib also serves to protect the bank from the action of the river. The tanks of both holders are 100 feet in diameter and 24 feet 6 inches deep; the inner lifts being 93 feet 7 inches diameter, and 23 feet 8 inches deep. The middle and outer lifts are 95 feet 6 inches by 24 feet 2 inches, and 97 feet 8 inches by 24 feet 4 inches, respectively. The guide frame consists of 12 standards, 73 feet in height, which are supported by 3 rings of horizontal girders. The structural steel and iron are from the Camden (N. J.) Iron Works."

THE dollar rate is now effective in Millville, N. J., and the people are seemingly appreciative of the fact, if one may judge from the orders for services that are coming in.

AT the instance of the Union Trust Company, of Boston, Mass., Mr. C. E. York has been appointed Receiver for the Farmington (N. H.) Gas Company.

THE projectors of the San Angelo (Tex.) Gas Company have been granted an extension of 6 months' time for the commencement of construction work, which period was specified in the franchise as January 1st, 1908.

THE residents of Chatham, N. J., are considering the advisability of constructing a gas works for operation on municipal account. They now operate an electric light plant and a water supply. The Public Service Corporation, of New Jersey, has tried to do business with the Chatham folks on this account, but the terms the latter tried to exact were altogether too one-sided.

MR. HERBERT J. WATERBURY has succeeded Mr. R. McKenzie as Superintendent of the Marquette (Mich.) Gas Company.

MR. FRANCIS S. THAYER is in active harness as local Superintendent of the Clinton (Mass.) Gas Light Company. Wonder why the Woonsocket (R. I.) management let him go? He certainly has a thorough knowledge of the business.

SUPERINTENDENT A. M. HART, of the Hannibal (Mo.) Gas Company, is feeling quite chipper these days, his exceptional vivacity being occasioned by the action of the proprietors in securing handsome office quarters in the Nelson building. Here he proposes to arrange a representative display of gas using appliances.

SOME evenings ago Supt. F. A. Goodwin, of the Northampton (Mass.) Gas Company, gave an address to the Engineer Class of the Northampton Y. M. C. A., on the subject of gas manufacture which, if it might be so determined from the attention that was given to it by the Class, was instructive and interesting.

FROM the report of the year's operation of his department (Lamps and Lighting) Superintendent McCuen shows that the number and kind of lamps used on account of street lighting in Baltimore, Md., for the twelvemonth were: The total was 9,864 lamps, of these types: Incandescent gas, 7,174; incandescent vapor, 893; electric arcs, 1,970. The relative costs of the lamps are returned as follows: Electric arcs, $67.49; incandescent gas lamps, ordinary type, $9; park type, $11; incandescent vapor, $27.50. To the gas lamps maintenance must be added the cost of gas and which is billed at the rate of 72½ cents per 1,000 cubic feet.

AT the annual meeting of the St. Albans (Vt.) Gas Light Company the officers elected were: Directors, S. T. Bodine, Lewis Lillie, W. F. Douthirt, Paul Thompson and A. J. Smith; Superintendent and Treasurer, A. J. Smith.

IT is said that the new plant at Junction City, Kas., will be in active operation by the first prox. The selling rate is set at $1 per 1,000, the population to be supplied is close to 8,000, and the Company will start in with 300 consumers.

MR. EDMUND M. BLAKE, of Boston, Mass., is the latest applicant for a franchise to manufacture and supply gas to the residents of Joliet, Ills. He makes his tentative offer by remarking that he has "Long been impressed with the splendid opportunity for profitable investment presented in Joliet," etc. If Mr. Blake wishes to know more about Joliet he can certainly do so by inclosing to us a 2-cent postage stamp. Meamwhile he should not "put it on so thick." It does not sound well.

A CORRESPONDENT in Pittsburgh forwards the following under date of the 16th inst.: Among the last lot of decisions handed down by the Pennsylvania Supreme Court was that in the case of the Kittaning Borough against the Consolidated Natural Gas Company. The Borough passed an ordinance taxing gas mains that ran under its streets. The Company refused to pay the tax and the Borough brought suit in the County Court to recover $1,700, and was awarded a judgment. An appeal was taken to the Supreme Court, which decided to uphold the decision of the lower Court. It is likely the issue will be appealed to the Supreme Court of the United States.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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The JOURNAL is the official organ of the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JANUARY 20, 1908.

The Market for Gas Securities.

The market for Consolidated gas was quite animated early in the week, but at the close (probably on account of another large note issue) the gain was not only wiped out, but figures were made considerably lower. The opening to-day (Friday) was 101⅛ to 102⅛, and sales were few. There is no reason for the decline other than the note issue. It is understood that the Supreme Court will pass on the rate decision late in the spring. City gas bonds are in good demand.

In out-of-town shares prices are generally better, notably in the instance of Peoples, of Chicago, which is 87¼ bid. Massachusetts Gas Companies are decidedly stronger, quite some business having been done in both common and preferred at an advance of full 4 points. The Municipal Company, of Albany, N. Y., has declared its regular quarterly dividend of 2½ per cent.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY

JANUARY 20.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	101⅛	102⅛
Central Union Gas Co.—				
1st 5's, due 1972, J. & J	3,000,000	1,000	92	97
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual	3,000,000	100	—	170
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	85	90
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	90	98
New York and East River—				
1st 5's, due 1944, J. & J	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J	1,500,000	—	97	101
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	98	100
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	½	¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,600,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	20,500,000	100	92	92½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	92	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	87	88
Preferred	3,026,500	100	107⅛	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	90
Mortgages, 6's	3,000,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,000,000	50	—	50
" Prior Lien 5's	4,618,000	1,000	—	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	x,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Lt. Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,000,000	—	100	105
" Bonds, 5's	10,000,000	—	101	102½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	10	82	—
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	97	97¼
Preferred	2,500,000	100	93¾	93
Bonds	10,000,000	1,000	104	104½
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	86¾	87
Preferred	25,000,000	100	83	83¾
Montreal, Canada	9,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	87¾	88
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Elec. Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco, Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	92	—
St. Paul Gas Light Co.	1,200,000	100	45	47
1st Mortgages, 6's	600,000	1,000	113	114
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	90¾	—
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	102	—
Washington, D. C.	2,000,000	20	340	345
1st Mortgage, 6's	600,000	—	—	—
Western, Milwaukee	4,000,000	—	—	—
Wilmington, Del.	600,000	50	220	—

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City ... 113
Baxter & Young, Detroit, Mich ... 123
B. E. Chollar, St. Louis, Mo ... 123
Cruse-Kemper Co., Philadelphia, Pa ... 112
Davis & Farnum Mfg. Co., Waltham, Mass ... 124
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
Empire Gas Improvement & Construc. Co., N.Y. City. 121
Frank D. Moses, Trenton, N. J ... 126
Frederic Egner, Norfolk, Va ... 128
Frederick J. Mayer, Baltimore, Md ... 109
H. M. Byllesby & Co., Chicago, Ills ... 124
Humphreys & Glasgow, New York City ... 124
Isbell-Porter Co., Newark, N. J ... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 125
The Gas Machinery Co., Cleveland, O ... 108
The Jeffrey Manufacturing Co., Columbus, O ... 122
United Gas Improvement Co., Philadelphia, Pa ... 119
Western Gas Construction Co., Fort Wayne, Ind ... 132

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City ... 113
Bartlett, Hayward & Co., Baltimore, Md ... 128
Baxter & Young, Detroit, Mich ... 123
Connelly Iron Sponge & Governor Co., New York City. 121
Continental Iron Works, Brooklyn, N. Y ... 126
Cruse-Kemper Co., Philadelphia, Pa ... 112
Davis & Farnum Mfg. Co., Waltham, Mass ... 124
Deily & Fowler, Philadelphia, Pa ... 128
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
Empire Gas Improvement & Construc. Co., N.Y. City. 121
Frank D. Moses, Trenton, N. J ... 126
Humphreys & Glasgow, New York City ... 124
Isbell-Porter Co., New York City ... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 125
Lloyd Construction Co., Detroit, Mich ... 114
Logan Iron Works, Brooklyn, N. Y ... 128
Quintard Iron Works, New York City ... 124
R. D. Wood & Co., Philadelphia, Pa ... 126
Riter-Conley Mfg. Co., Pittsburgh, Pa ... 127
Stacey Mfg. Co., Cincinnati, O ... 127
The Gas Machinery Co., Cleveland, O ... 108
The Jeffrey Mauufacturing Co., Columbus, O ... 122
United Gas Improvement Co., Philadelphia, Pa ... 119
Western Gas Construction Co., Fort Wayne, Ind ... 132

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md ... 128
B. E. Chollar, St. Louis, Mo ... 123
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
Humphreys & Glasgow, New York City ... 124
Semet-Solvay Co., Syracuse, N. Y ... 122
The Gas Machinery Co., Cleveland, O ... 108
United Gas Improvement Co., Philadelphia, Pa ... 119
Western Gas Construction Co., Fort Wayne, Ind ... 132

SCRUBBERS AND CONDENSERS

Continental Iron Works, Brooklyn, N. Y ... 126
Cruse-Kemper Co., Philadelphia, Pa ... 112
Davis & Farnum Mfg. Co., Waltham, Mass ... 124
Economical Gas Apparatus Construc. Co. Toronto, Ont. 123
Isbell-Porter Co., Newark, N. J ... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 125
Logan Iron Works, Brooklyn, N. Y ... 128
R. D. Wood & Co., Philadelphia, Pa ... 126
Riter-Conley Mfg. Co., Pittsburg, Pa ... 127
Stacey Mfg. Co., Cincinnati, O ... 127
The Gas Machinery Co., Cleveland, O ... 108
Western Gas Construction Co., Fort Wayne, Ind ... 132

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
R. D. Wood & Co., Philadelphia, Pa ... 126

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
Isbell-Porter Co., Newark, N. J ... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind ... 125
Stacey Mfg. Co., Cincinnati, O ... 127
The Gas Machinery Co., Cleveland, O ... 108
Western Gas Construction Co., Fort Wayne, Ind ... 132

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich ... 106
The Gas Machinery Co., Cleveland, O ... 104
Western Gas Construction Co., Fort Wayne, Ind ... 132

GAS METERS.

American Meter Co., New York and Philadelphia ... 131
Detroit Meter Company, Detroit, Mich ... 231
D. McDonald & Co., Albany, N. Y ... 129
Helme & McIlhenny, Philadelphia, Pa ... 131
John J. Griffin & Co., Philadelphia, Pa ... 88
Keystone Meter Co., Royersford, Pa ... 130
Maryland Meter and Mfg. Co., Baltimore, Md ... 130
Metric Metal Co., Erie, Pa ... 131
Nathaniel Tufts Meter Co., Boston, Mass ... 130
New York Improved Meter Co., New York City ... 130
Pittsburg Meter Co., East Pittsburg, Pa ... 129
Rotary Meter Co., New York City ... 107
United States Meter Co., Brooklyn, N. Y ... 111

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 131
D. McDonald & Co., Albany, N. Y..... 129
Helme & McIlhenny, Philadelphia, Pa..... 131
John J. Griffin & Co., Philadelphia, Pa..... 88
Keystone Meter Co., Royersford, Pa..... 130
Nathaniel Tufts Meter Co., Boston, Mass..... 130
New York Improved Meter Co., New York City..... 130
Pittsburg Meter Co., East Pittsburg, Pa..... 129

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City..... 130

WATER METERS.

Pittsburg Meter Co., East Pittsburg, Pa..... 129

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Donaldson Iron Co., Emaus, Pa..... 124
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
R. D. Wood & Co., Philadelphia, Pa..... 126

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 122
Perkins Co., New York City..... 122
Westmoreland Gas Coal Co., Philadelphia, Pa..... 123

GAS MAIN STOPPERS.

Edward A. Behringer, New York City..... 82
Safety Gas Main Stopper Co., New York City.....123, 127

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 126

GAS TAPPING MACHINES.

George Light, Dayton, O..... 114
H. Mueller Manufacturing Co., Decatur, Ills..... 115

CANNEL COALS.

Perkins & Co., New York City..... 122

STOKING MACHINERY.

G. A. Bronder, New York City..... 121

CONVEYORS—ALL KINDS.

Cruse-Kemper Co., Philadelphia, Pa..... 112
C. W. Hunt Company, New York City..... 113
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
G. A. Bronder, New York City..... 121
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 125
The Gas Machinery Co., Cleveland, O..... 103
The Jeffrey Manufacturing Co., Columbus, O 122
Western Gas Construction Co., Fort Wayne, Ind..... 132

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 125
Stacey Mfg. Co., Cincinnati, O..... 127

GAS ENRICHERS.

Standard Oil Co., New York City..... 133

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 133
The Jeffrey Manufacturing Co., Columbus, O..... 122

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills..... 115

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills..... 115

(*Continued on page 106.*)

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Am 28. Desire position as superintendent of

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RESULTS LAST FIVE YEARS.

Increase of net profits each year in a city of 35,000 population:

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Position wanted as superintendent or manager of gas and electric plant, by the superintendent of the plant which made the above showing; 15 years' experience in construction, operation and management. References, owners of the property I am now with and others.

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FOUR SECOND-HAND PURIFIERS.

Dimensions, 10 feet by 14 feet by 3 feet deep, with dry center valve and connecting pipes 10 inches diameter. Seal 16 inches deep. Inquire of the

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(Concluded from page 105.)

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 113
William H. Bristol, New York City..... 116

GAS GOVERNORS.

Chaplin-Fulton Mfg. Co., Pittsburg, Pa..... 127
Connelly Iron Sponge & Governor Co.,New York City 121
Isbell-Porter Co., Newark, N. J..... 112
Pittsburg Meter Co., East Pittsburg, Pa..... 129
R. D. Wood & Co., Philadelphia, Pa..... 126
Reynolds Gas Regulator Co., Anderson, Ind..... 111

FUEL ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N. Y..... 113

CEMENTS.

C. L. Gerould, Pittsburgh, Pa..... 126

RETORTS AND FIREBRICKS.

Baltimore Retort and Firebrick Co., Baltimore, Md... 120
Didier-March Co., Baltimore, Md..... 109
Gas Bench Construction Co., St. Louis, Mo..... 120
Henry Maurer & Son, New York City..... 113
James Gardner, Jr., Co., Bolivar, Pa..... 122
J. H. Gautier & Co., Jersey City, N. J..... 120
Laclede-Christy Clay Products Co., St. Louis, Mo..... 110
Missouri Firebrick Co., St. Louis, Mo..... 122
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 116

INCLINED RETORTS.

Baltimore Retort and Firebrick Co., Baltimore, Md. 122
Didier-March Co , Baltimore, Md..... 109
Gas Bench Construction Co., St. Louis, Mo..... 120
Laclede-Christy Clay Products Co., St. Louis, Mo..... 110
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 116

VERTICAL S'S.

Connelly Iron Sponge & Gov.Co.(Drake's [Eng.] System) 121
Didier-March Co., Baltimore, Md..... 109
Gas Bench Construction Co., St. Louis, Mo.... 120
Laclede-Christy Clay Products Co., St. Louis, Mo. 110
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 116

REGENERATIVE FURNACES.

Baltimore Retort and Firebrick Co., Baltimore, Md.. 122
Bartlett, Hayward & Co., Baltimore, Md..... 125
Didier-March Co., Baltimore, Md..... 109
Gas Bench Construction Co., St. Louis, Mo..... 120
J. H. Gautier & Co., Jersey City, N. J..... 122
Laclede-Christy Clay Products Co., St. Louis, Mo..... 110
Missouri Firebrick Co., St. Louis, Mo..... 122
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 116

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N. Y 126
Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Isbell-Porter Co., Newark, N. J..... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 125
Logan Iron Works, Brooklyn, N. Y..... 128
R. D. Wood & Co., Philadelphia, Pa..... 121
Stacey Mfg. Co., Cincinnati, O..... 127
The Gas Machinery Co., Cleveland, O..... 108
Western Gas Construction Co., Fort Wayne, Ind..... 132

INCANDESCENT GAS LAMPS.

General Gas Light Co., Kalamazoo, Mich..... 115
Geo. G. Ramsdell, New York City..... 112
Welsbach Company, Gloucester, N. J..... 118

BURNERS.

Wm. M. Crane Co., New York City..... 116

STREET LAMPS.

Thos. T. W. Miner, New York City..... 116
Welsbach Street Lighting Co., New York and Phila.. 118

DRILLS—ROCK AND STONE.

The Jeffrey Manufacturing Co., Columbus, O..... 122

PULVERIZERS.

The Jeffrey Manufacturing Co., Columbus, O..... 122

PURIFIERS.

Connelly Iron Sponge & Governor Co., New York City. 121
Cruse-Kemper Co., Philadelphia, Pa..... 112
Davis & Farnum Mfg. Co.. Waltham, Mass..... 124
Isbell-Porter Co., Newark, N. J..... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind 125
R. D. Wood & Co., Philadelphia, Pa..... 126
Stacey Mfg. Co., Cincinnati, O..... 127
Western Gas Construction Co., Fort Wayne, Ind..... 132

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City 121

VALVES.

Continental Iron Works, Brookln, N. Y..... 126
Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Economical Gas Apparatus Construc.Co., Toronto, Ont. 123
Isbell-Porter Co., Newark, N. J..... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 12
Ludlow Valve Manufacturing Co., Troy, N. Y..... 113
R. D. Wood & Co., Philadelphia, Pa..... 126
Stacey Mfg. Co., Cincinnati, O..... 127
The P. H. & F. M. Roots Co., Connersville, Ind..... 115
Western Gas Construction Co., Fort Wayne, Ind..... 132

EXHAUSTERS.

Connelly Iron Sponge & Governor Co.,New York City 121
Connersville Blower Company, Connersville, Ind..... 101
Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Isbell-Porter Company, Newark, N J..... 112
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 125
The P. H. & F. M. Roots Co., Connersville, Ind..... 115

PURIFIER AND SCRUBBER TRAYS.

Cabot Mfg. Co., Hoboken, N. J..... 123
Western Gas Construction Co., Fort Wayne, Ind..... 132

GAS STOVES.

American Meter Co., New York and Philadelphia..... 131
Fred. K. Wells Company, New York City..... 67
Keystone Meter Co., Royersford, Pa..... 130
Maryland Meter & Manufacturing Co., Baltimore, Md... 130
Nathaniel Tufts Meter Co., Boston, Mass..... 130

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 120

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 125
Continental Iron Works, Brooklyn, N. Y..... 126
Cruse-Kemper Co., Philadelphia, Pa..... 112
Davis & Farnum Mfg. Co., Waltham, Mass..... 124
Deily & Fowler, Philadelphia, Pa..... 128
Economical Gas Apparatus Construc. Co., Toronto, Ont. 123
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 125
Logan Iron Works, Brooklyn, N. Y..... 114
R. D. Wood & Co., Philadelphia, Pa..... 126
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 127
Stacey Mfg. Co., Cincinnati, O..... 127
Western Gas Construction Co., Fort Wayne, Ind..... 132

STORAGE TANKS.

Davis & Farnum Mfg. Co., Waltham, Mass..... 122
Stacey Mfg. Co., Cincinnati, O..... 127
Western Gas Construction Co., Fort Wayne, Ind..... 132

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 127

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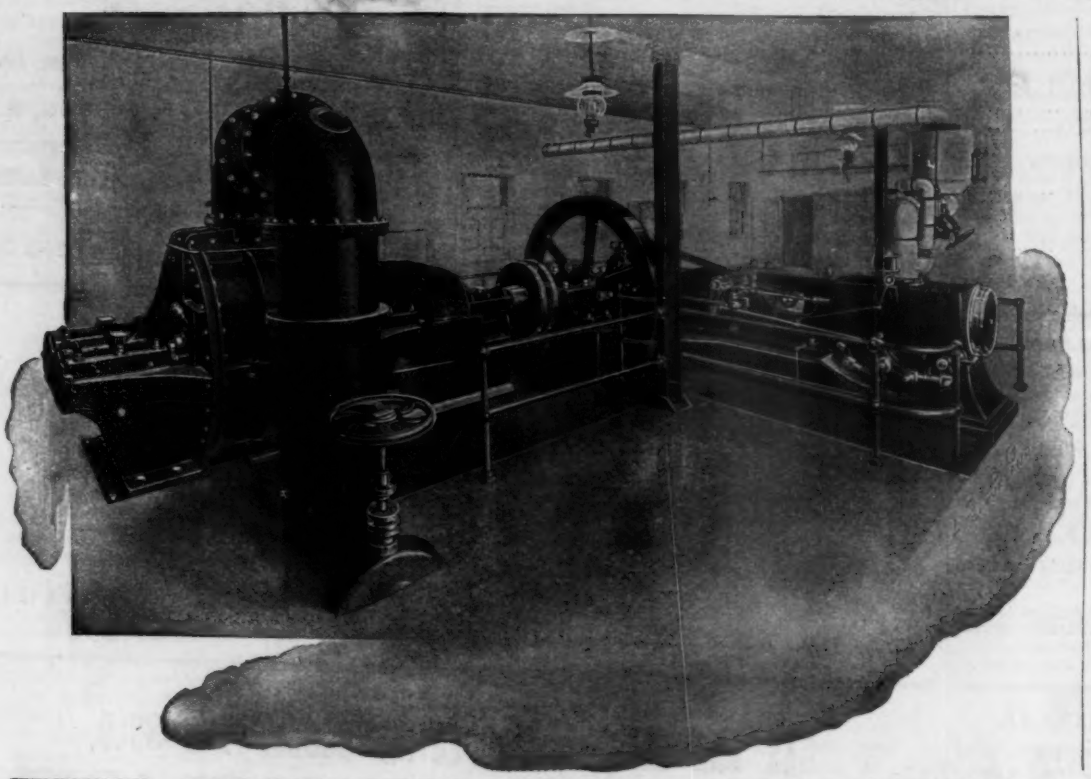

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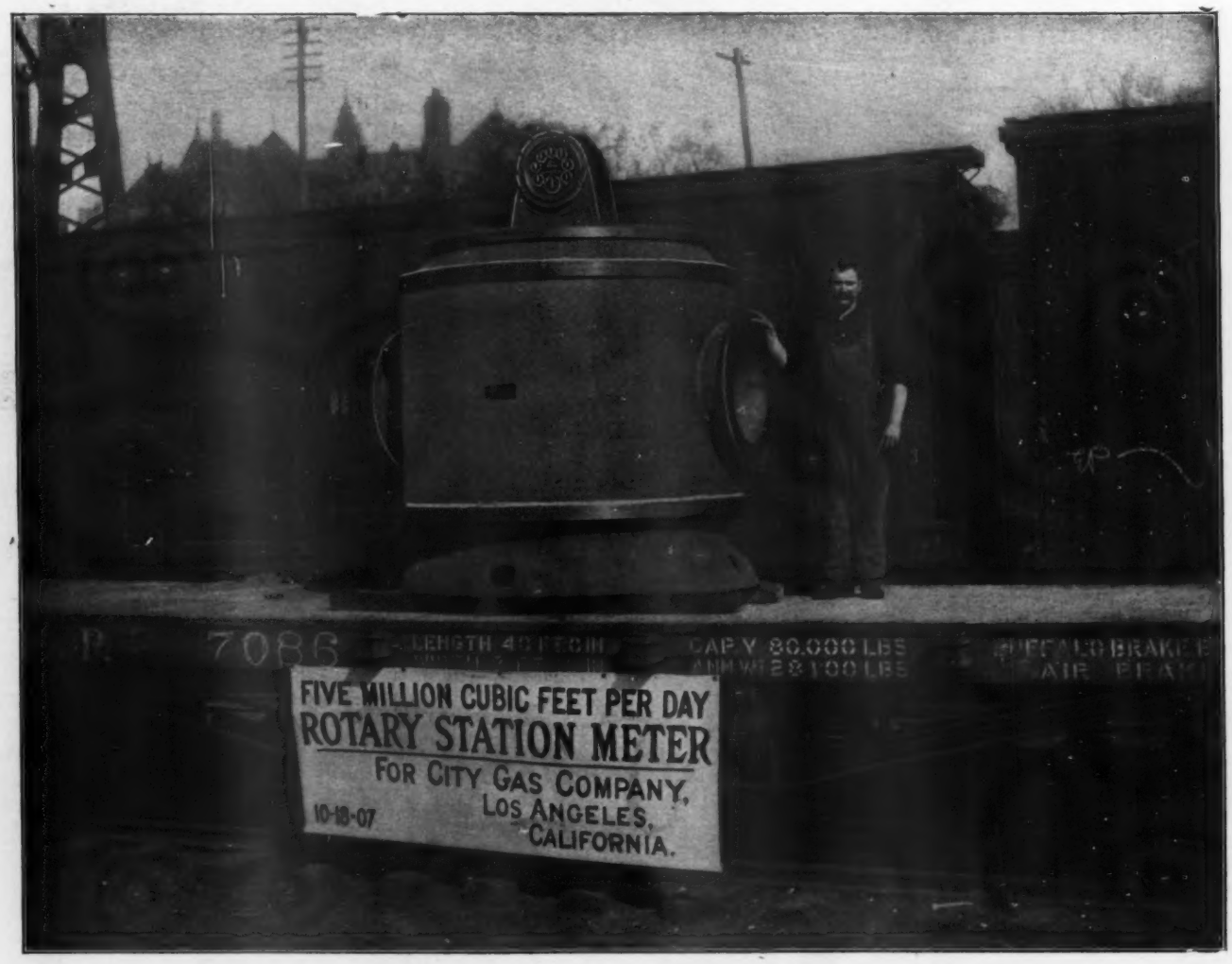

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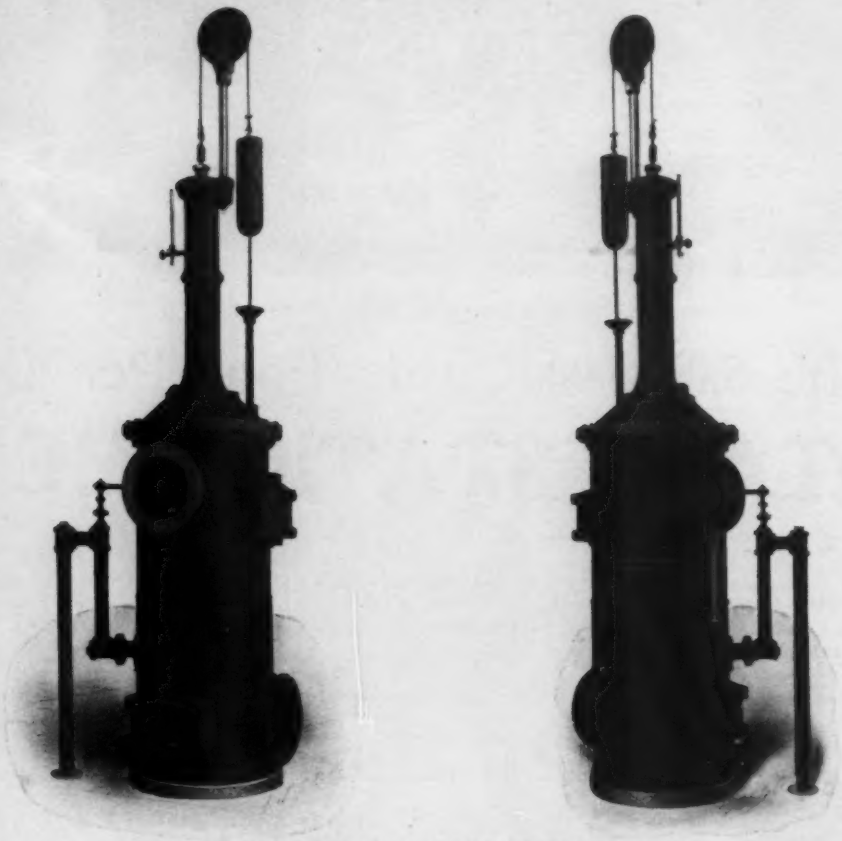

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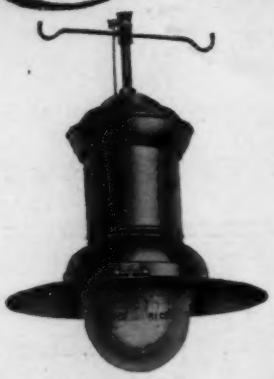

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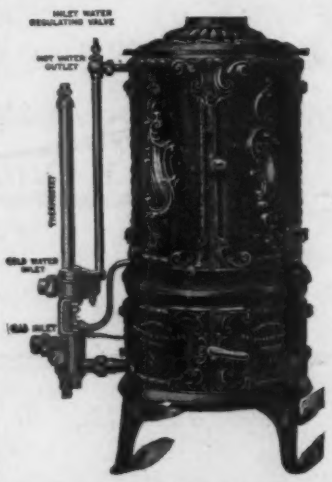

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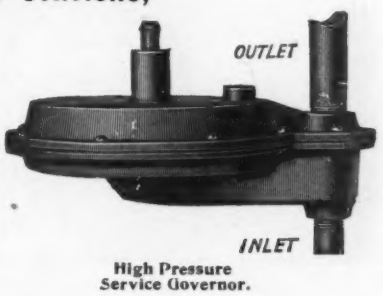

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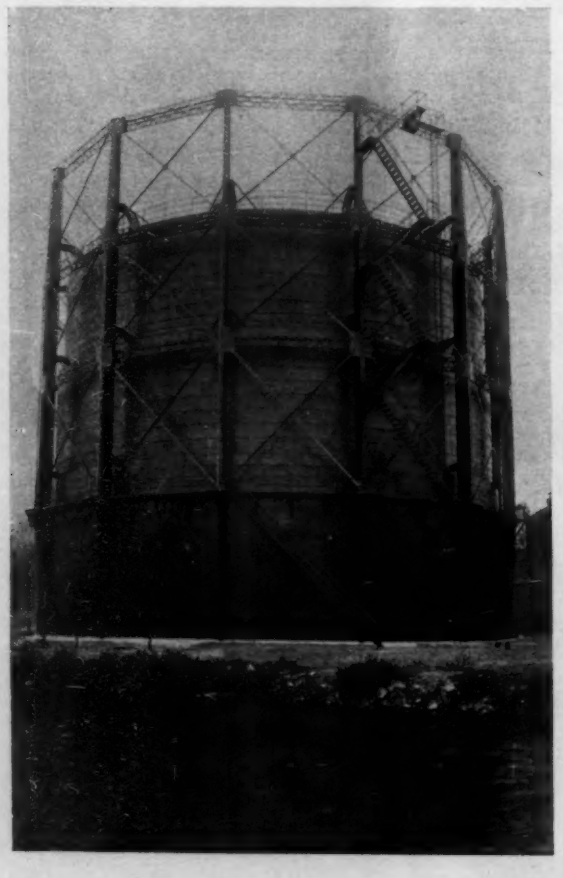

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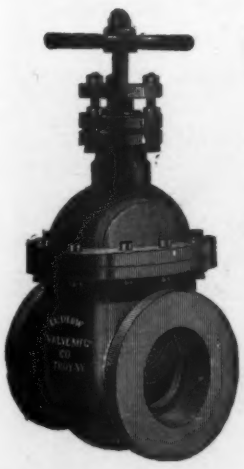

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TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

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For Handling Coal and Coke in Gas Works.

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If you are interested in the subject, we will take pleasure in sending you photographs of some of the plants we have installed upon receipt of your card, and will give such information as is in our power if you will let us know your requirements.

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For Gas, Water and Electric Light Companies, at

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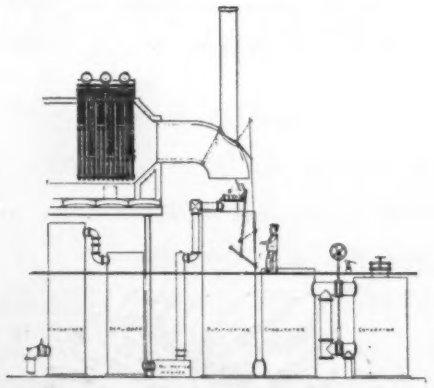

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THE LLOYD INTENSIVE SCRUBBER.
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"The Stationary Rotary."

Rotates the WATER instead of the SCRUBBER.

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An extra heavy boss with a rib on each side gives additional strength to these clamps. By their use weak or light mains that could not otherwise be tapped may be tapped with perfect safety.

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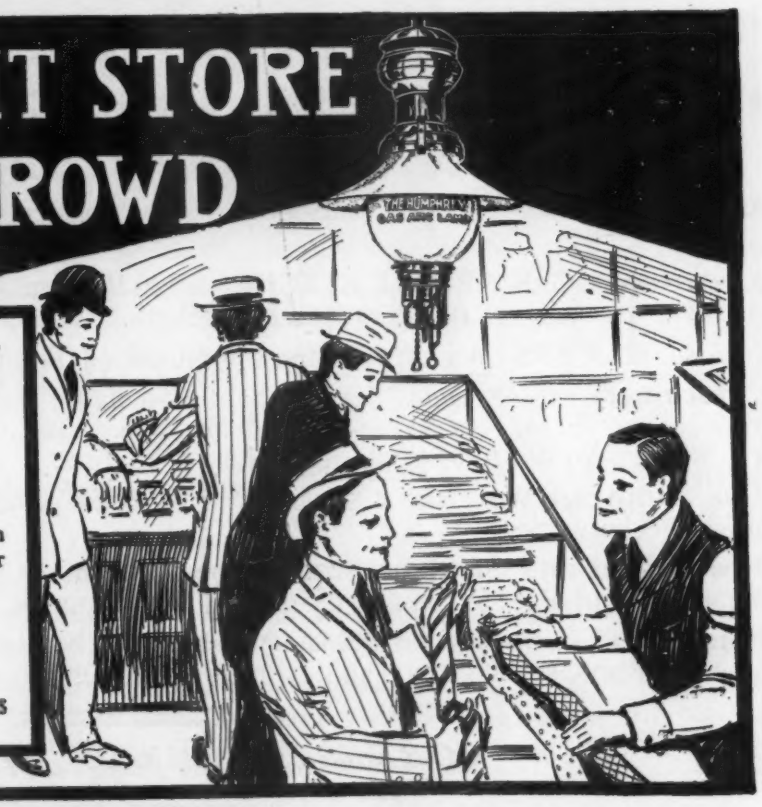

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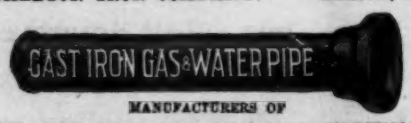

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If you could see the **inside** of the **BRAY**, if you could have pointed out to you those **little details of manufacture**, those things which have an **all-important bearing** on the **durability**, if you could compare the **BRAY BURNER part** for **part** and **material** for **material** with any other burner on the market, then you could better understand why

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AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

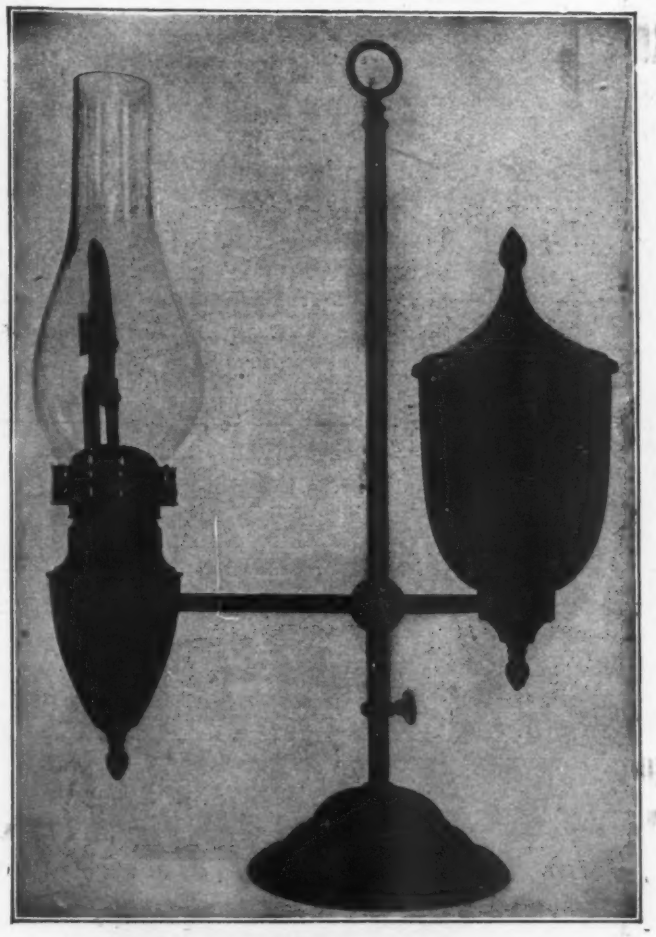
FEBRUARY, 1908.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Sat.	1	5.40 PM NM	6.10 AM
Sun.	2	5.50	6.10
Mon.	3	5.50	6.10
Tue.	4	5.50	6.10
Wed.	5	5.50	6.10
Thu.	6	9.40	6.10
Fri.	7	10.40	6.10
Sat.	8	11.50 FQ	6.10
Sun.	9	12.50 AM	6.00
Mon.	10	1.50	6.00
Tue.	11	2.50	6.00
Wed.	12	3.40	6.00
Thu.	13	4.30	6.00
Fri.	14	5.10	6.00
Sat.	15	No L.	No L.
Sun.	16	No L. FM	No L.
Mon.	17	No L.	No L.
Tue.	18	6.10 PM	8.00 PM
Wed.	19	6.10	8.50
Thu.	20	6.10	9.50
Fri.	21	6.10	11.00
Sat.	22	6.10	12.00
Sun.	23	6.20	1.00 AM
Mon.	24	6.20 LQ	2.10
Tue.	25	6.20	3.20
Wed.	26	6.20	4.20
Thu.	27	6.20	5.30
Fri.	28	6.20	5.40
Sat.	29	6.20	5.40

TOTAL HOURS DURING 1908.

By Table No. 1.

	Hrs. Min.
January	228.30
February	187.30
March	192.00
April	160.10
May	155.10
June	138.00
July	155.50
August	173.40
September	185.20
October	214.00
November	218.10
December	226.40
Total, yr.	2235.00



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

***

10-Candle Power.

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This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

FEBRUARY, 1908.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Complete Lighting in One Hour	Complete Extinguishing in 50 Minutes
		From Time Given	
		P. M.	A. M.
Sat.	1	4.47	6.07
Sun.	2	4.47	6.07
Mon.	3	4.47	6.07
Tue.	4	4.47	6.07
Wed.	5	4.57	6.02
Thu.	6	4.57	6.02
Fri.	7	4.57	6.02
Sat.	8	4.57	6.02
Sun.	9	4.57	6.02
Mon.	10	4.57	6.02
Tue.	11	4.57	6.02
Wed.	12	5.07	5.57
Thu.	13	5.07	5.57
Fri.	14	5.07	5.57
Sat.	15	5.07	5.57
Sun.	16	5.07	5.52
Mon.	17	5.07	5.52
Tue.	18	5.07	5.52
Wed.	19	5.17	5.47
Thu.	20	5.17	5.47
Fri.	21	5.17	5.47
Sat.	22	5.17	5.47
Sun.	23	5.17	5.42
Mon.	24	5.17	5.42
Tue.	25	5.17	5.42
Wed.	26	5.22	5.32
Thu.	27	5.22	5.32
Fri.	28	5.22	5.32
Sat.	29	5.22	5.32

TOTAL HOURS DURING 1908.

	Hrs. Min.
January	481.50
February	329.15
March	351.50
April	341.50
May	233.05
June	218.10
July	282.55
August	254.55
September	292.25
October	420.45
November	374.30
December	411.05
	3992.35
Deduct on account of 50 min. extinguish'ng time	30.30
Total, yr.	3962.05

NEW YORK, 318 West 42d Street.
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....OF AMERICA....

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Controls and Operates the **Welsbach System of Street Lighting,**

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Uniformly SUCCESSFUL in 150 Cities and Towns.

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POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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Succeeds and Excels the Electric Light at One-Quarter the Cost.

THE BURNER.

Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
Will Not Discolor Fixtures.
Will Not Discolor Ceilings.

THE MANTLE.

Best Welsbach Quality.
Extra Strong and Durable.
Highest Maintained Candle Power.
Rich Mellow Light.

THE GLASSWARE.

Highest Quality Imported.
Special Design Inner Cylinder (No. 317).
Protection from the Falling of Heated Particles.
Increases Candle Power.

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Coney Island, N. Y.
Mexico, Mo.
Jacksonville, Fla.
Syracuse, N. Y. (2d contract).
Atlanta, Ga. (3d contract).
Holyoke, Mass.
Peoria, Ills.
Schnectady, N. Y. (2d contract).
Danbury, Conn.
Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
Sioux Falls, S. D. (3d contract).
Philadelphia, Pa.

TOTAL SETS INSTALLED TO JULY 1, 1907, ... 34
TOTAL SETS TO DATE, ... 668
TOTAL DAILY CAPACITY, ... 541,655,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.

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Manufacturers of all Material for the Construction of Coal Gas Benches.

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INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

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For Use in Works, Mains and Service Pipes. Shipped in 100-gallon Drums.

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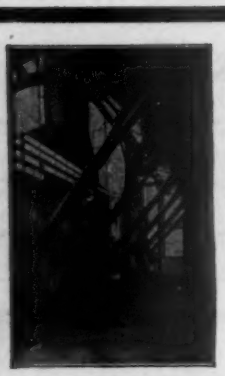

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Insure a Saving of 50 to 75 per ct.

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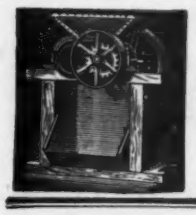

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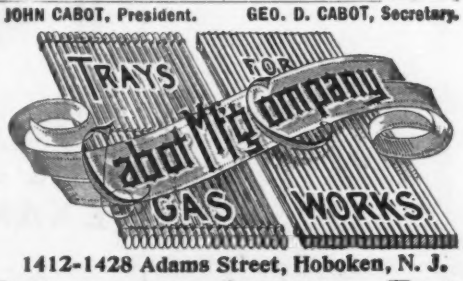

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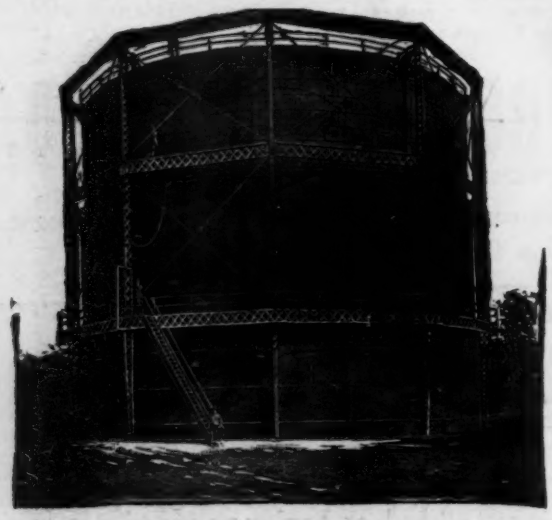

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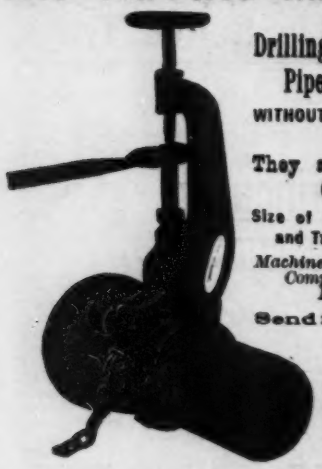

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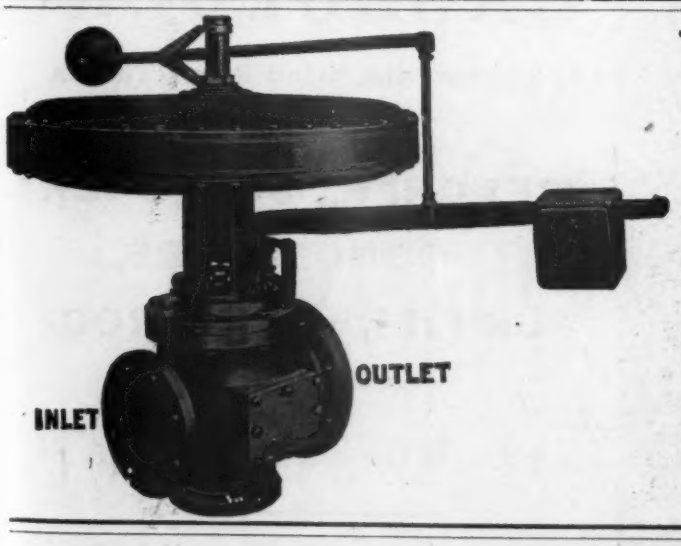

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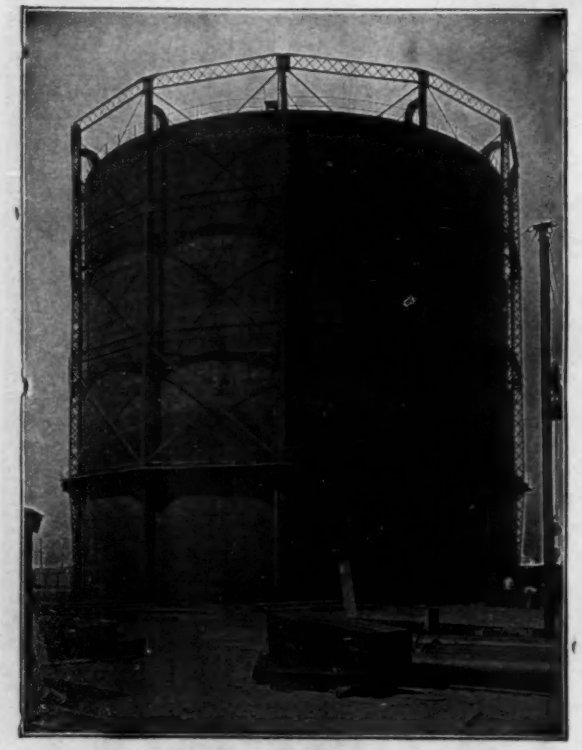

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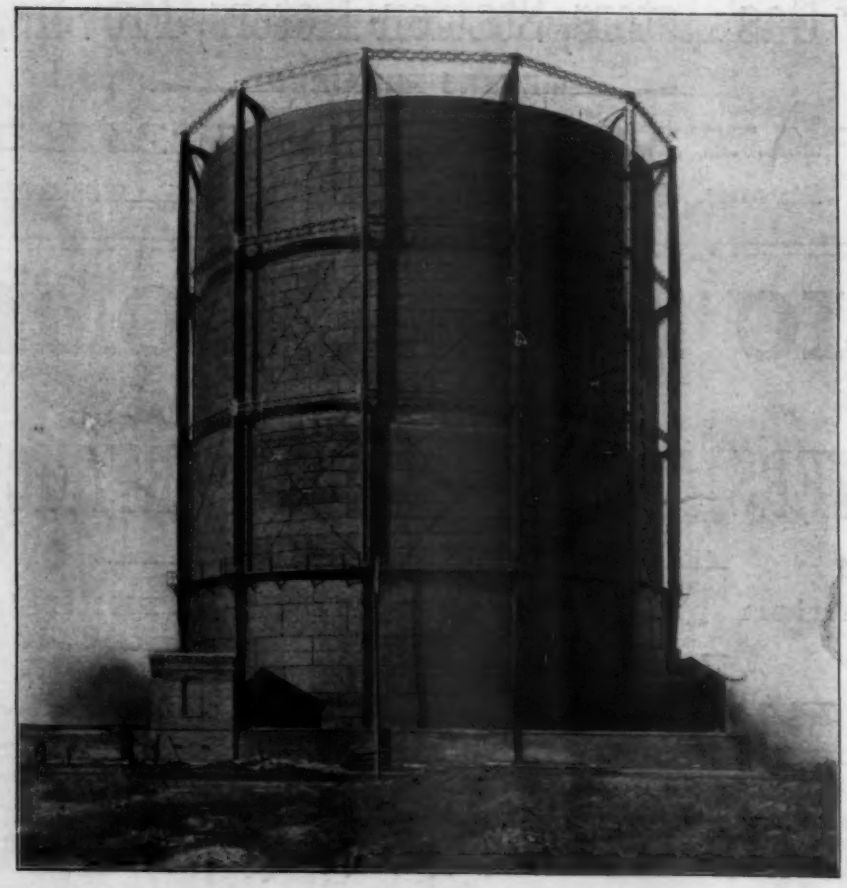

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